INTEREST RATE EXPECTATIONS FOR PENSION PLANS: INCENTIVES FOR DIVERGENT ACTUARIAL ASSUMPTIONS BETWEEN DOL AND FASB DISCLOSURES

By

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This study examines possible determinants of the expected interest rates reported (1) to the Department of Labor (DOL) and (2) as part of the financial statements per Statement of Financial Accounting Standards (SFAS) No. 36 of the Financial Accounting Standards Board. A comparison of the two sources of information reveals that management does not always report the same value for their interest rate expectations in both places. The study presents evidence about hypothesized forces that influence management's choice of divergent interest rate assumptions for the two reports.

Based on a model of the manager's reporting problem, hypotheses were derived about the relation between each reported rate and certain firm specific variables. The DOL interest rate was hypothesized to be directly related to opportunities for capital expansion and the pension plan ratio (the ratio of the present value of accumulated benefits to pension assets) and inversely related to liquidity. The SFAS No. 36 interest rate was hypothesized to be directly related to both the pension ratio and the contemporary return on pension assets.

Results indicated that the measures of capital expansion did not significantly explain either the actual level of DOL interest rate or the year-to-year change in DOL interest rate. Liquidity was positively associated with the change in DOL interest rate but not with the actual level of DOL interest rate. The pension ratio was directly related to both the actual level of DOL interest rate and the change in DOL interest rate.

The pension ratio was directly related to both the actual level of SFAS No. 36 interest rate as well as its year-to-year change. The return on pension assets was not related to either the actual level or the year-to-year change of SFAS No. 36 interest rate.

CHAPTER I
INTRODUCTION

1.1 Motivation

The implementation of FASB Statement No. 35 (SFAS 35) and FASB Statement No. 36 (SFAS 36) resulted in two sources of information about expected rates of return on the assets of defined benefit pension plans. These sources are (1) the sponsoring company's annual report and (2) the form 5500 annual report filed by the administrator of the pension plan with the Department of Labor (DOL). A comparison of the two sources of information reveals that management does not always report the same values for their expectations in both places.[1] This dissertation presents evidence about hypothesized forces that influence management's choice to use different interest rate assumptions for the two reports at the same point in time.

Evidence on this issue can serve several ends. First, academics have a traditional interest in how accounting choices are made. The generalized response to that interest is that choices are made to benefit someone. Answers posed here lend concreteness to that response in the context of the particular management problem of selecting expected interest rates.

Next, certain research, Feldstein and Seligman (1981) and Bodie, Light, Morck, and Taggart (1984), has identified regularities in choices of discount rates across firms. These studies do not, however, discriminate between the two kinds of reporting, reporting in the annual financial statements and reporting to the DOL.[2] The forces affecting

management when management makes the DOL reporting decision are not identical with the forces affecting management when management makes the reporting decision for SFAS 36 purposes. Therefore, the regularities or patterns of choices ought to be different between these two reporting problems for management. This study discriminates between the two kinds of reporting. The discrimination leads to more precision in identifying the manager's incentives in choosing "expected" interest rates.

Other classes of society also have an interest in evidence regarding how these reporting choices are made. Regulators have an interest in evidence about how accounting choices are made. Regulators periodically reevaluate current bounds on management discretion in order to decide whether current regulation is adequate or to propose new bounds. In either case they require, as inputs, knowledge of current management decision processes.

In the current context, the FASB and the DOL are regulators that have required disclosure of expectations about the return on pension funds. This dissertation provides evidence about possible management strategies in response to the requirements. The evidence may (1) be justification for the adequacy of current regulation, (2) be used to devise strategies for implementing new regulations, or (3) be used to help predict the effects of new regulation. Finally, managers and students of business have an interest in knowledge of contemporary business strategies.

1.2 History of the Disclosures

Cumulatively, SFAS 35 and SFAS 36 require disclosure in company financial statements of (1) the actuarial present value of accumulated

plan benefits, (2) the interest rate assumption used to compute the present value, and (3) net pension assets.[3] Curiously, this information had already been, at least in principle, available for several years through the Department of Labor (DOL).[4]

The two standards of the FASB were issued as interim measures to promote disclosure while the FASB's pension task force studied the problem. The first statement, SFAS 35, sets disclosure and measurement requirements for financial statements of pension plans. These requirements include the disclosure of the actuarial present value of accumulated plan benefits (PVAB) and the significant assumptions used in the computation, especially the interest rate. This enhanced information disclosure was thought by the FASB to be useful to the presumed primary users of such disclosures, particularly the participants of the plan.[5]

The interest rate so disclosed is used in the computation of the actuarial present value. The interest rate reflects

> . . . the rate of return during the periods for which payment of benefits is deferred and shall be consistent with returns realistically achievable on the types of assets held by the plan. . . (SFAS No. 35, page 8).

Therefore, the interest rate used for SFAS 35 purposes is the expected rate of return on plan assets.

SFAS 36, in turn, sets disclosure requirements for pension plan sponsors. This standard requires that the actuarial present value of accumulated plan benefits (PVAB), the interest rate used to compute it, and net pension assets (PA) be disclosed in footnotes to the company's financial statements. The disclosures made due to SFAS 36 are computed according to the SFAS 35 standards. Therefore, the interest rate

disclosed in the sponsor's financial statements is nominally defined by the previous quote.

A significant amount of interest and controversy was associated with the formulation of these standards.[6] The first draft of SFAS 35 (April 1977) prompted 700 letters of comment. The second exposure draft (July 1979) produced another 300 letters. The final version passed 4 to 3.

Ernst and Whinney (1980, page 59) stated that the controversy was provoked by inclusion of the actuarial statement as part of the financial statements of the pension plan. The dissent to the standard also focused in a particularly strong way on this issue. The first paragraph of the dissent said that inclusion of actuarial statements in financial statements adds cost to the audit and lends "an unjustified aura of reliability to estimates of the future" (SFAS No. 35, page 15) (emphasis added). If users of pension plan information desire detailed information, the dissent reasoned, the user can obtain the annual report filed with the Department of Labor.[7] It may be concluded that significant costs and benefits were associated with opening up the company's financial statements as a second source of information about pension plans.

As indicated, the government had already been promoting disclosure of pension plan information. The Employee Retirement Income Security Act (ERISA, P.L. 93-406, effective January 1, 1975) requires that pension plan administrators have annual reports filed with the DOL and the Internal Revenue Service (IRS). The annual report of the plan includes an audited financial statement and an actuarial statement.[8] Besides being used to promote public disclosure (Section 104(a)(1)), the

actuarial statement (schedule b of form 5500) is used to determine the sufficiency (according to regulation) of current funding.

The actuarial statement filed with the DOL is a product of the management and actuary and lists the assumptions used to generate the actuarial statement. ERISA requires that the actuary state that the assumptions

> (i) are in the aggregate reasonably related to the experience of the plan and to reasonable expectations, and
>
> (ii) represent his best estimate of anticipated experience under the plan (P.L. 93-406 Sec. 103 (a)(4)(B)).

Again, the nominal definition of the interest rate disclosed on a form 5500 annual report is that the interest rate is a best estimate of the return on plan assets.[9]

There is no requirement by either the government or the FASB that the assumptions for the purpose of reporting to the DOL are the assumptions for the SFAS 35 or SFAS 36 purposes, though such a rule was proposed. The Conference Committee Joint Explanation proposed ". . . a single set of actuarial assumptions will be required for all purposes (e.g., for the minimum funding standard, reporting to the DOL and to participants and beneficiaries, financial reporting to stockholders, etc)" (Pomeranz et al., page 46). No such regulations were forthcoming, however, and some firms have used the discretion implicit in the two reports to use different interest rates. Nonetheless, a reading of the regulations establishing what the two interest rates represent would argue that a similar, if not identical, measurement is required in both cases.

1.3 Determinants of DOL and SFAS 36 Reporting Choices

This dissertation provides evidence on possible forces that operate on the choice of interest rates in the two cases. A model is first developed that captures the manager's problem of selecting (1) the interest rate for the Department of Labor and (2) the interest rate for financial reporting purposes. The model is developed by constructing an environment with the manager as a participant. The manager's activity is to choose the pair of interest rates such that the value of the firm is maximized. For this decision, we assume that there is substantial congruence between the interests of the manager and the interests of the owners.

Hypotheses drawn from the model are statements about the relations between interest rate choices and elements of the firm specific environment. The analysis concludes that the model setting constitutes a sufficient condition for the hypotheses to hold. However, alternative models might produce identical hypotheses. Thus, unless all possible alternative models are excluded, no claim can be made that the model description is a necessary condition for the relations to hold.

Further, additional relations may hold that are not captured by the model. That is, the model may omit considerations that are important to all managers. Such omitted variables that are uncorrelated with the included variables lead to unexplained variation. Also, the importance to managers of some feature included in the model may be conditioned on an omitted variable. The omission of the conditioning variable would again lead to lack of explanatory power. However, for those hypotheses that can be drawn from the model, evidence is generated on the ability of the hypotheses to explain actual reporting choices.

The discussion of the environment is commenced with the assumption that the use to which the different reports are put motivates the manager to adjust the "interest rate expectation" in each report. That is, the reporting choice is assumed to be based on the prospective consumption of the report.

The form 5500 report is produced for DOL and IRS regulators. The primary purpose for which the report is prepared is to determine whether the sponsor has complied with government regulations regarding contributions to the pension fund. In complying with this regulation, management is required to report an "expected" interest rate; hence a manager has the flexibility to choose an "expected" interest rate in order to optimize the cash flows to the firm.

The "expected" interest rate as reported to the DOL influences the calculation of the regulated minimum and maximum contributions. ERISA requires an annual contribution that is related to the present value of benefits. Increases in the expected interest rate on the pension fund (i.e. discount rate) imply a lower present value of benefits, hence a lower required contribution. In effect, as the true rate of return rises then less contribution is required to meet the contracted benefits. Since the true rate is unobservable at the time of the report, regulators rely on management "expectations." Therefore, a management that wants to contribute less (more) will report a high (low) expected return.

On the other hand, the sponsor's financial statements are used by owners, creditors, labor, politicians, and journalists. These groups have less information about the security of pension benefits than managers and can be expected to use the sponsor's financial statements.

For example, labor or individuals who stand in for labor are imperfect monitors of the execution of the pension contract. In the course of estimating the likelihood of the pension contract being carried out, monitors will use the financial statement of the sponsor.

The financial statements are the product of management and as such management will seek to manipulate the pension disclosure on the financial statements within discretionary bounds. The auditor, in turn, is the source of those discretionary bounds. Only those interest rates which are defensible to the auditor, and are therefore credible, will be reported on financial statements. The attestation function of the auditor further raises the probability of the pension disclosure being used. Attestation enhances the importance of the reporting decision to management and makes it worthwhile for management to be persuasive to the auditor.

Because the interest rates for the two reports need not be the same, each interest rate represents a distinct choice to be made by the manager. Therefore, in conjunction with the contribution schedule, the two interest rates provide the manager with a total of three choice variables to use in maximizing the after-labor cost value of the firm. The forces that drive management's choices of these variables will be briefly mentioned next, after which, the complete model to be estimated is presented.

The decision of how much to contribute involves the following factors:

i) the relative returns on corporate assets versus pension trust assets,

ii) the need to use cash to meet corporate fixed claims, and

iii) the response by interested parties to the level of funding.

The first factor driving the level of contribution is the relative returns on corporate assets versus pension trust assets. The contribution to the pension plan is an allocation of capital between two kinds of assets: the corporate assets and the pension assets. The manager will allocate capital to the asset with the highest net return. Where the net return to corporate assets is greater (less) than the net return to the pension assets, the manager will set a lower (higher) contribution level.

The first factor leads, in turn, to a choice of a DOL interest rate. Where ERISA might nominally bind or prevent the desired contribution, the manager can change the interest rate reported to the DOL. By claiming that the expected return on pension assets is high (low), the manager then may contribute less (more). Therefore, the first factor produces this hypothesis: when the returns on corporate assets exceed the returns to pension assets and a lower pension contribution is desired, the manager will choose a higher DOL interest rate.

The second hypothesis posits that firms may lower the pension contribution in order to meet other fixed claims. Managers are concerned with having adequate amounts of cash available to meet obligations payable in cash. If the lowest cost method of meeting the claims is by lowering pension contributions, the firms will implement that approach regardless of the previously hypothesized return considerations. Thus, the second hypothesis is that firms with relatively more fixed claims due will have a higher DOL interest rate.

The third attribute management looks at when choosing the DOL interest rate is the current level of accumulated benefits compared to

the current pension assets. Where the comparison is by ratio, the result is termed a pension ratio (PR) in this dissertation. Two forces operate against each other in determining the net impact of PR on the management's choice of DOL interest rate. The first force on management is from labor. The second is from creditors and owners.

The first force to operate on management (because of PR) is the demand by labor. Labor desires a well-funded plan. A management that chooses to poorly fund a plan receives higher demands from labor. Faced only with this first force, the third hypothesis would be that a poorly funded plan calls for an upward adjustment in the level of funding. That is, a plan that was historically a poorly funded plan (i.e. a high PR) would choose a low DOL interest rate so as to increase funding. In general, and in the absence of other forces, management will supply the demanded funding (to appease labor).

However, there is a countervailing second force. This force, operating against labor's demand, comes from creditors and owners. Creditors and owners will insist, to the extent possible, that labor bear a portion of the risk of the firm. Creditors and owners bear less risk and labor bears more risk when a lower contribution is made. The opposing forces from creditors and owners versus labor determine, at the margin, the equilibrium value of PR.

The previous discussion concludes that the PR of any plan is the result of the forces of labor working against the forces of owners and creditors to arrive at the extent to which the plan is funded. Where there is no evidence that the balance of forces has changed, the same degree of funding can be expected to continue. For example, suppose that management knows the "true" normal cost but the forces have settled

at a degree of funding that is 80% of benefits that accrue each year. Management can manufacture a normal cost at 80% of the size of true normal cost by choosing a high DOL interest rate. From year to year the proportion of benefits covered by assets would be constant and the PR ratio would be constant.

The variable PR, then, describes the state where the force of owners and bond holders have "equalized." Where the forces have settled at underfunding (overfunding), the DOL interest rate can be used to implement the underfunding by being set high (low). The third hypothesis therefore states that when the PR ratio is high, the DOL interest rate will be high.

In contrast to the decision concerning reports to the DOL, the decision of what interest rate expectation to use on the financial statements is influenced by

i) the funding level of the pension plan, and

ii) the currently attainable return on the pension fund assets.

The first attribute management should look at when choosing the SFAS 36 interest rate is the level of funding of the pension plan. Again, a variety of forces acts on management's decision. As before, creditors, owners, and labor have an interest in the level of funding. This time, however, creditors, owners, and labor all have a coinciding interest in higher returns to the pension plan when all else is equal. Therefore, a higher funding ratio will be associated with a higher SFAS 36 interest rate.

This argument contrasts with the arguments about the DOL interest rate. When the level of cash spent out of the firm is at issue (as with the DOL rate), labor contends with creditors and owners for the cash.

When a projection of future returns to cash already in the fund is made, all parties would like such cash already in the fund to have a high interest rate. All else equal, a high real return benefits all parties.

The interest rate used in the footnotes to financial statements is nominally defined as a best estimate of future returns to the fund. Managers will use the disclosed interest rate as an opportunity to predict high returns to the pension assets. In turn, if creditors, owners, or labor accepts the disclosed interest rate there will be less demand faced by management. If creditors, owners, or labor does not believe the high interest rate, then the PR ratio disclosed by management will be ineffective in controlling demand on the management. Nevertheless, management may achieve control of demand and has little to lose by choosing a higher interest rate. As the funding level deteriorates, the demands on management are higher and the incentive to choose a higher interest rate is greater. Therefore, the first hypothesis related to the SFAS 36 interest rate is that the disclosure rate will be higher as the PR of the pension plan deteriorates.

The second hypothesis related to the SFAS 36 disclosure posits that the interest rate for financial statement purposes depends on the current return on plan assets. The auditor's bounds on the discount rate depend on certain evidence, part of which is the contemporary return on the plan assets. Higher current returns lead to a higher SFAS 36 interest rate allowed by the auditor.

These hypotheses for both interest rates can be expressed as a set of equations (say, linear) relating the choice of interest rates to independent variables. The set of equations that represent management

decision processes for the model firm together with the expected signs of the coefficients is shown as

$$R_j = \underset{(+)}{\alpha_0 + \alpha_1 \text{ CAPEXP}_j} + \underset{(-)}{\alpha_2 \text{ LIQ}_j} + \underset{(+)}{\alpha_3 \text{ PR}_j} + e_{1j} \qquad \text{A1}$$

$$I_j = \underset{(+)}{\beta_0 + \beta_1 \text{ PR}_j} + \underset{(+)}{\beta_2 \text{ r}_{pj}} + e_{2j} \qquad \text{A2}$$

where

R_j is the DOL interest rate for firm j,

I_j is the SFAS 36 interest rate for firm j,

CAPEXP_j is the return on the corporate assets compared to the return on the pension fund,

LIQ_j is the liquidity position of the firm,

PR_j is the ratio of present value of accumulated benefits to pension assets, and

r_{pj} is the contemporary return on pension assets.

In estimating (A) there are two alternative ways of measuring the dependent variables. The first is the simple level of I and R for a given year for each firm. The second alternative is the change in interest rates from one year to the next. This second method has an advantage in that the firm acts as a control for itself and serves to better isolate the cause of the management's choice compared to using the pure levels as the dependent variables. For example, suppose the manager chooses 6% as the interest rate in 1980. It may be that the cause of the 6% choice for 1980 can be better discerned with the additional knowledge that the 1979 rate was 5% (than if the 1979 rate was also 6%). The increase of 1% in this example may be more informative about forces on management than the simple knowledge that the 1980 rate was 6%.

The value of the two alternative ways of measuring the dependent variables can be further shown in the following way. Suppose that management uses the interest rates to respond to environmental variables. With no cost to adjusting the interest rates, each firm will be free each year to choose the 'best' interest rate possible for the given environmental variables. Regardless of the frequency or magnitude of the changes in the environmental variables, the 'best' interest rates will be used by management. No values should be observed either over time or across firms other than the 'best' interest rate. Consequently, in a setting where there is no cost to adjustment, a cross-sectional test should easily identify the relation between the environmental variables and the interest rates.

In contrast, if there is a cost of adjustment so that changes in interest rates are made only infrequently, then the observed level of interest rate can vary widely for any given level of independent variable. In effect, sponsors may allow excursions away from 'optimal' combinations of response variables and environmental variables before an adjustment to the response variable is made. In such a case, a company's environmental variable would need to cross some threshold before causing a change in the response variable. Firms with extreme levels of variables will have crossed the threshold and such firms will be candidates for changing interest rates.

1.4 Overview and Results Summary

The sample of firms used to test the hypotheses is drawn from the FASB Statement 36 Data Bank Version II (Version II). Version II contains information from the footnote to the annual report of the sponsor as required by SFAS 36.

These firms were compared with the Compustat Tape and 774 companies were identified as common. These 774 companies did not possess all the information necessary for each operational definition. Nonetheless, for the 774 companies, the Blue Book of Pension Funds (BBPF) by ERISA Benefits Incorporated, Volumes for 1982 and 1983, was consulted for information about the actuarial assumptions made by companies in the form 1500 reports to the Department of Labor.

The 1982 Volume of the BBPF predominantly contains data for the year 1978 and 1979 by plan. Six hundred and seventeen sponsors out of the 774 companies had some sort of data available for these years. The 1983 Volume of the BBPF contains at least one plan update per sponsor for 486 of the 617 sponsors. The variety in the data requirements of the operational definitions causes the precise sample size to change; hence, tests of the hypotheses generally have a sample size of less than 300 companies.

The remainder of the dissertation is divided into five chapters. In Chapter II a review of the pertinent literature is presented. The purposes of the review are to provide a sketch of the background literature that (1) identifies the value to the sponsor of various funding strategies, (2) attempts to test for the existence of those strategies, (3) attempts to test for the impact of extant strategies on firm claimants, and (4) attempts to identify management strategies in interest rate choices.

Chapter III provides more detail in the generation of the hypotheses. A fundamental model of the manager's decision process is given. This fundamental model is then overlaid with additional, if somewhat

"softer," arguments. The total set of arguments is the final basis for a set of hypotheses that are presented in Chapter III.

Chapter IV discusses the methodologies and operational definitions used to test the hypotheses. Each methodology has a motivation which is included with the description of the methodology. The discussion of the operational definitions includes a summary of the data collected for each variable.

Chapter V presents the results of the tests. The results are described by hypothesis. That is, for each hypothesis, the evidence that all methodologies bring to bear are discussed. Such an organization hopefully gives a better overview of the influence of each variable. The final chapter of the study, Chapter VI, summarizes the overall research effort and findings, with comments on limitations.

The results for the DOL interest rate hypotheses indicate that the actual level of DOL interest rate was not explained by either the capital expansion or liquidity variables. In contrast to those variables, significant explanation of the actual level of DOL interest rate was contributed by the pension ratio. Second, when the dependent variable was the change in DOL interest rate there was again no support for the capital expansion variable as an explanation. However, liquidity explained the change in DOL interest rate, at conventionally significant levels. Finally, the pension ratio was also significant in explaining the change in DOL interest rate.

The results for the SFAS 36 interest rate indicate support for the first hypothesis but not for the second. Consistent with the first hypothesis, both the SFAS 36 interest rate and the change in SFAS 36 interest rate were directly related to the pension ratio at

conventionally significant levels. However, the results indicated that neither the actual level of SFAS 36 interest rate nor the change in rate is directly related to the contemporary return on pension assets.

At an overall level, the model fit statistics were low. For the model of DOL reporting, using the change in DOL interest rate as a dependent variable resulted in a better model fit than when the actual level of DOL interest rate was used as a dependent variable. Just the opposite occurred for SFAS 36 interest rate reporting. The model fit for the equation with the actual level of SFAS 36 interest rate as the dependent variable was higher than that for the equation with the change in SFAS 36 interest rate.

1.5 Notes

1. Only defined benefit plans are contemplated in this dissertation.
2. For examples of firms that reported both interest rates in the footnotes to accompany financial statements see Business Week (August 9, 1982) and Financial Analysts Journal (March/April 1982).
3. Statement of Financial Standards No. 36, paragraph 8.
4. P.L. 93-406 Sec. 104(a)(1) and Sec. 106(a).
5. SFAS 35 "Basis for Conclusions."
6. Ernst and Whinney (1980), pages 8-10, reviews the background of SFAS 35.
7. See the dissent to SFAS 36. Factor 4 deals specifically with whether the FASB should have an interest in pension plans' accounting.
8. P.L. 93-406 Sec. 103(a)(1)(B)(i) and (ii).
9. An alternative interpretation can be proposed. In effect, the alternative interpretation states that the assumptions are to be reasonable only in aggregate. Taken together, the alternative states, the assumptions are reasonable, though individually the assumptions may be unreasonable.

CHAPTER II
REVIEW OF RELEVANT LITERATURE

This chapter presents the results of previous research concerning (1) management strategies for funding pension plans, (2) tests of which factors influence management's decisions in funding pension plans, (3) how those decisions empirically affect valuation by the firm's claimants, and (4) tests of which factors influence management's choice of interest rates. The final section relates this study to prior research.

2.1 Principles of Management Strategies in Funding Pension Plans

The enactment of the Employee's Retirement Income Security Act (ERISA) prompted considerable speculation regarding the impact. A wide ranging piece of legislation, ERISA was frequently analyzed by academics who focused on a single provision out of the many provisions of the law. The analyses of these academics generally allowed the particular provision selected to drive the decisions of all interested parties and the resulting equilibrium was asserted to be the (or an) impact of ERISA.

One of the earliest analyses of ERISA was by Sharpe (1976). The feature analyzed by Sharpe was the insurance provision which allowed a company to terminate a pension plan and either (1) retrieve the assets in excess of the amount required to fully fund the accumulated vested benefits or (2) assign (or 'put') the excess of insured accumulated vested benefits over plan assets to the Pension Benefit Guarantee Corporation (PBGC). In a one period model this 'put' is valuable to the company since any company with an underfunded defined benefit pension

plan can terminate the plan and avoid the remaining payments on benefits promised to employees. Employees are indifferent to this strategy since (most of) their benefits are guaranteed by the PBGC. If the PBGC is an imperfect monitor of the company's activities or even if the PBGC is a perfect monitor but is too slow to have regulations altered, then the PBGC is powerless to prevent accepting a position with an expected net loss. The management does not benefit by funding and does benefit by not funding. Less funding increases the value of the put since larger amounts of benefits are avoided on termination. Therefore, all companies will fund only the minimum amount in order to maximize the value of the put and hence the sponsoring firm.

This 'put' also generates a portfolio decision rule for investing the minimum amount so funded. The sponsor benefits more if the portfolio of the pension assets is risky. The sponsor of a pension plan with risky assets in the portfolio bears none of the downside risk of the assets; the downside risk is borne by the PBGC. If the return is positive then the sponsor may retrieve the excess assets, if any. Thus, this provision of ERISA encourages investing in risky assets.

A second provision, which was focused on by Black (1976) and Tepper (1981), has been asserted to provide opposite incentives when the firm and plan are ongoing entities. The tax code allows the company to deduct the contribution to the pension fund before computing the company's income tax. Further, the returns on the pension assets are not taxed. The pension assets can therefore be expected to compound at the pretax rate of return, in contrast to the company assets. In effect, in an economy with a single asset, the asset pays a tax premium that most

tax entities must give up. The pension trust does not give up the premium and as a result grows faster than other taxed entities. Thus, the argument militates in favor of completely prefunding the pension plan as the lowest cost method of meeting the promised benefits.

In extending this argument to economies with several assets differentiated by the tax law, the argument generates a portfolio choice rule for the pension trust as well as a funding choice rule for the company. The portfolio choice rule is that the asset paying the largest tax premium (the largest tax rate) is the asset in which the pension trust should invest. For example, when the returns on bonds are taxed as ordinary income and returns on equity are taxed as capital gains, then the gross pre-tax returns on bonds should be higher, all other things equal, to induce investors to hold bonds. The pension fund should then invest solely in bonds.

By coincidence, in certain economies the tax-differentiated assets may also be differentiated by risk. For example, bonds may be less risky than stocks. It might, therefore, be asserted that either extreme strategy would alter the risk/return attributes of the corporate claims. That is, choices in the pension assets' portfolio flow back to the value of the corporate assets.

Such an effect may occur, for example, if sufficient downturns in the value of pension assets require the firm either to terminate the plan (exercise the put) or to make up the downturn out of other corporate assets. In the case of downturns they require the firm to take action, and in general, a risk/return choice made for the portfolio of pension assets flows through to affect the risk/ return attributes of the sponsor.

Therefore, changes in the portfolio to meet the prescriptions of Black (1976) and Tepper (1981) might create a risk/return pair in the sponsor that is different from that desired by the management. Black (1976) suggested that the sponsor could alter the sponsor's issued ratio of debt to equity to restore the original distribution of returns for each claimant. That is, the sponsor can alter the capital structure of the sponsor's balance sheet to offset the effect of the change in the portfolio of pension assets. Tepper (1981) suggested the claimants can adjust their personal holdings to restore the distribution of returns.

Bulow (1980) has responded that a one to one adjustment of debt in the pension trust to debt issued by the company may not produce the desired effect. Despite the tax arbitrage implications of issuing corporate debt to prefund the pension plan (deducting interest for the corporation and paying no taxes on trust income), assets held by the trust are not accessible by corporate creditors with the same ease that assets in the company would be. The investment in the pension assets would be tainted collateral to the bond holder of the company. Therefore, the prefunding rule generated by Black and Tepper may not be optimal in a practical sense for sponsors.

A third provision of ERISA is that, despite the previous incentives for or against funding, a minimum funding rule does exist. This minimum funding rule has allowed managers to engage in high risk projects that they might previously have passed up. Logue (1980) argued that a pension plan that is voluntarily unfunded represents a guaranty by management that management will keep the company low risk. To explain this effect, recognize first that an unfunded pension plan is a lower priority claim on corporate assets than bonds. If the company goes

bankrupt, then the managers will be without resources at their own retirement. A bond holder in a company with an unfunded pension plan can estimate a greater incentive on management's part to preserve the low risk aspect of the firm. Therefore, when ERISA required plans to be funded, ERISA diluted a desirable bonding mechanism between managers and the firm.

Eaton and Rosen (1981) point out that compensation schemes other than pension plans can be better tailored to the circumstances of particular executives and would therefore give more precise control over manager decisions. Tax qualified plans require consistent treatment of employees and this militates against their intentional use as a bonding device for top management. Therefore, the importance of funding to influence management investment choices is suspect.

Finally, an integration by Harrison and Sharpe (1982) of the decision environments of Sharpe (1976) and Black (1976) to reconcile the disparate decision rules concluded that the combination of forces did not cause an interior solution to the funding question but rather showed that either one force or the other force dominated. The forces seemed to compete and either minimum funding or maximum funding incentives won.

The fundamental insight of this theoretical literature is that management, firm claimants, and regulators are not indifferent to the state of the pension plan. Pension plan asset and liability information about the plan is relevant to firm management and claimants since the pension assets may operate as a tax deferred savings account for the company or a valuable 'put' position against the PBGC. The pension plan asset and liability information is relevant to pension plan participants since the plan assets are the primary source of payment of the

employees' retirement benefits. More precision about prescriptions for firm decisions regarding funding and investment strategies for pension plans is not possible. Each argument presented in this section should dovetail with other parts of the firm to produce a pension contribution decision that is an integral part of management's cash flow and disclosure strategies.

The difficulty with this deductive literature, however, is that a dovetailing of each argument with other parts of the firm has not been achieved. The literature described so far has dealt with a collection of individually parsimonious models of the sponsor. A single parsimonious model has not yet captured all relevant ingredients for the manager, owner, bond holder, labor, and regulator problems. As a result, the ability of these arguments to describe observed behavior is limited (see the next sections on empirical findings).

2.2 Tests of Factors Influencing Management's Funding Decisions

A fundamental investigation of empirical patterns of funding and investment was undertaken by Friedman (1982). Friedman used the form 5500 information filed for the year 1977 to collect information about (1) total pension benefits owed, (2) pension trust assets, and (3) the portfolio composition of the pension trust. For 593 companies Friedman consolidated (1) pension plan information for plans directly supervised by companies together with (2) the pension plan information for plans of identified subsidiaries. This consolidation allows a comparison of data from the form 5500 with Compustat information pertaining to the consolidated company. A cross-sectional test of the inputs to the funding decision was performed.

The results are not completely consistent with any of the suggested models. A lack of any pattern would suggest an indifference by management to the funding and investment policies of the pension trust. Patterns do emerge, although not always as hypothesized. Equations 2.1, 2.2, and 2.3 of Table 2.1 summarize Friedman's results. Table 2.2 defines the variables used in the equations. First, Friedman reported a relation between unfunded pension claims and debt that had a coefficient of .14. Larger corporate debt to equity ratios were therefore associated with larger pension liabilities. This is consistent with riskier firms underfunding pension plans, possibly to take advantage of the PBGC insurance.

Though equation (2.1) was consistent with the Sharpe (1976) argument regarding funding levels, the tests of portfolio composition were distinctively negative for the argument. The Sharpe (1976) hypothesis would require that more volatile firms invest more heavily in equity. Equation (2.2) shows instead that the coefficient relating the volatility of corporate earnings to the percentage of equities held in the trust had a t-statistic of -2.5. The more volatile firms seemed to offset that volatility by investing in less risky assets, a result opposite to that hypothesized by Sharpe (1976).

Therefore, equations (2.1) and (2.2) represent a strategy somewhat different from that envisioned by Sharpe. A more complex strategy may be required in the complex regulatory environment in which companies operate. For example, Bulow (1980) suggests that exercising the put against the PBGC by terminating a plan even though the company was not bankrupt would work at least once in the life of each firm where the PBGC was slow to adjust to company conditions or was an imperfect

monitor. More than one attempted termination could lead to possible sanctions by the IRS. In effect, when a large unfunded liability (such as Chrysler had) could be developed, it might be used as leverage for other government concessions regardless of the company's position otherwise. Thus, while equation (2.1) is consistent with Sharpe (1976), equation (2.2) says that the termination strategy is not the strategy employed by risky firms.

Next, though it may be commonplace to say that the size of the pension assets depends on the size of the liability, it is instructive to measure the magnitude of the effect. The firm to firm variation in funding (to emphasize that it is not the same firm over time) due to the pension liability was measured in equation (2.3). This equation says that a $1 increase in the pension liability would result in a $.60 increase in the pension assets, all other things equal.

Other firm specific factors added to equation (2.3) (trend in earnings, volatility of earnings, and size of earnings) generally had no apparent effect on the size of the pension assets. Thus, companies follow some systematic procedures in funding and investment though not consistent with contemporary theory.

Certain aspects of Friedman's tests require additional explanation. For example, Friedman's equations are incomplete specifications of the problem since the pension liability is subject to managerial reporting strategies. Friedman's use of the 1977 form 5500 prevented the incorporation of actuarial assumptions in the analysis. It was not until 1978 that the actuarial assumptions were encoded on form 5500. This is crucial since the pension liability Friedman used in the analysis is not merely a benefit level to be read from the employees' contract but

rather the pension liability is the present value of the benefits. The choice of interest rate affects the level of pension liability dramatically. If the interest rate is itself the object of some managerial strategy then the Friedman equations are incomplete to study the rate choice phenomenon.

Francis and Reiter (1984) also present a cross-sectional test of funding levels as a function of firm specific attributes. The sample was drawn from the FASB Statement 36 Data Bank Version II. The model was estimated for two years, 1980 and 1981. The model estimated for 1981 is shown as equation (2.4) in Table 2.1. Generally the t-statistics are small.

Of the usual arguments made (tax, insurance, and agency) Francis and Reiter say that for them the test of the agency argument depends on the two variables BENEFITS PER EMPLOYEE and DEBT TO EQUITY. Recall that debt to assets entered Friedman's model as a significant variable. However, DEBT TO EQUITY does not enter the Francis and Reiter model. Thus, half of the variables used to examine the agency hypothesis are insignificant in the Francis and Reiter test.

The explanation of why the Francis and Reiter results differ from those of Friedman may hinge partially on the difference in dependent variables used between studies. Friedman uses the unfunded pension liability scaled by equity while Francis and Reiter use the pension assets scaled by the pension liability.

The novel variable that does enter as a significant explainer of funding policy in both years for Francis and Reiter is BENEFITS PER EMPLOYEE. However, notice that a simplification of their model results in

$$\frac{\text{PENSION ASSETS}}{\text{PENSION LIABILITY}} = \alpha + \beta \quad \frac{\text{PENSION LIABILITY}}{\text{\# EMPLOYEES}} + e \qquad (1)$$

The same variable (PL) appears as the denominator on the LHS of the equation (1) and as the numerator on the RHS, thus contributing to a possible spurious negative effect.

If the objective is to test the importance of #EMPLOYEES on the level of assets, then the relationship could have been directly specified as

$$\frac{\text{PENSION ASSETS}}{\text{NET WORTH}} = \alpha + \beta \quad \frac{\text{\# EMPLOYEES}}{\text{NET WORTH}} + e \qquad (2)$$

As a final comment, Francis and Reiter had available, but did not incorporate, the interest rates used to compute the pension liability. The results after standardizing for interest rates may have been different.

The conclusion of the previous studies regarding the funding of pension plans reveals that the basic determinants of risk and return to the company have not explained much of the funding policy of plan sponsors. The R^2s have ranged from .07 to .59. A serious limitation may have been the cross-sectional nature of the tests. It is an empirical question hinging on data limitations and the magnitude of the forces influencing behavior, but a noise reduction technique would be to use a test of changes over time rather than a cross-sectional test at one point in time. A test of changes in behavior controls for each firm over time and may pick up effects lost in a cross-sectional study. Further, neither study controlled for the effect of interest rates on

the level of pension liabilities; therefore the noise generated by the measurement differences in disclosed data may prevent a higher R^2.

2.3 Tests of the Impact of Management Decisions on Market Value

Given a manager's choice about the funding level, the question remains whether these choices have effects on shareholder wealth or the market value of assets. Oldfield (1977), Feldstein and Seligman (1981), Gersovitz (1980), Feldstein and Morck (1983), and Daley (1984) estimate the cross-sectional impact of funding levels on share prices and firm values.

Oldfield (1977) was concerned about whether the market offset the value of stock because of unfunded pension liability. The value of stock ought to be the value of the shareholders' claims after other costs have been covered. The unfunded pension liability is one such cost, and as the unfunded liability increases the value of the stock should fall. Oldfield's cross-sectional test was an early documentation that unfunded pension liabilities in fact depress the value of the stock.

By 1981, Feldstein and Seligman (1981) and Gersovitz (1980) had each estimated a cross-sectional model relating the value of a firm to firm attributes. Contributions of Feldstein and Seligman included (1) the use of the value of the firm as a dependent variable (instead of just equity) and (2) two additional control variables: the R&D expenditure and the beta of the firm. The Oldfield result was retained for both (1) equity and (2) the total value of the debt plus equity in the presence of other control variables; that is, larger levels of unfunded pension liability depress the value of the firm (or equity). On the other hand, Gersovitz recognized that the Sharpe (1976) argument implied

a differential impact of adding a dollar of unfunded liability for firms with low levels of unfunded liability than for firms with high levels of unfunded liability. His results were consistent with this implication.

Feldstein and Morck (1983) begin by specifying a general market valuation equation as in equation (2.5) in Table 2.3. Both historical cost and inflation data were used as alternatives in the operational definitions. There are, therefore, two versions of the controls. The results are summarized as equation 2.5.

Initially, equation (2.5) was estimated using 132 firms and inflation adjusted data. In equation (2.5), the coefficient for UVB was insignificant with a t-statistic of 1.74. Estimating the equation with historical cost measures produced a different result.

When historical cost accounting measures rather than inflation adjusted variables were used, UVB became significant. Of six variables, five became more significant than the original equation, two (including unfunded vested benefits) became significant, and one (RD/A) decreased in significance. Compared to the original equation, R^2 rose from .51 to .68. Therefore, the best model fit by Feldstein and Morck for the value of the firm using UVB produced an R^2 of .68 and a t-statistic for the unfunded liability of -2.83. That is, an increase in the size of the unfunded liability leads to a smaller value of the firm.

Feldstein and Morck recognize the heterogeneity of interest rate assumptions. A desirable feature would be to use only the benefit levels across firms rather than the present value of benefits. However, the benefit levels are not routinely reported and, therefore, an ad hoc correction is made. Once the correction is made, the valuation equations are re-estimated.

The Feldstein and Morck effort to back out the impact of differential interest rates is to adopt a rule of thumb transformation of the present value of benefits to some common interest rate. The rule of thumb could have been linear or non-linear. For either case the results of studies using a rule of thumb to transform the present value should be treated with caution since they add another relation between the level of contractual benefits and reported pension liability besides the following:

1. presumed dependence of management interest rate choice on benefit level, and
2. the arithmetic dependence of present values on interest rates.

The intent of adding a third relation may be to neutralize these two relations. However, the impact of the added relation may be to continue (or perhaps introduce) spurious correlations between V/A and the management's interest rate choice.

To illustrate the potential effect, suppose that the present value of accumulated benefits (PV) is written as

$$PV = B_T e^{fT},$$

where

B_T is the benefit accumulations from the introduction of the pension plan to the current year,

f is the interest rate Feldstein and Morck coded as the company's discount rate,

T is the time until the benefits are to be paid.

The adjusted present value (APV) Feldstein and Morck calculate is

$$APV = PV\ (c/f) = B_T e^{fT}\ (c/f) = (e^{fT}/f)\ B_T\ c.$$

where

c is the common interest rate to which Feldstein and Morck intend to standardize.

The adjustment amounts to using f to offset e^{fT} but the adjustment will not produce an APV invariant to the manager's choice of f. The variable APV may still be either an increasing or decreasing function of f; it is unknown which effect occurs.

Feldstein and Morck used a linear adjustment to two different standard interest rates for valuation purposes. The competing standard interest rates used were the Baa bond rate in 1980 and the average interest rate across plans. Once the adjustment to the common interest rate is made, the previous equations are re-estimated. For the models explaining the value of assets, the adjusted liability measure improves both the R^2 and the SSR for inflation adjusted data. Remarkably, the adjusted liability measure does not improve the t-statistic for the adjusted liability when the measure of assets is historical cost. The adjusted liability worsens both the R^2 and the SSR.

Myers (1983) points out, in reference to Feldstein and Morck, that cross-sectional tests can present difficulties in interpreting causality. For example, excluded background variables may cause both sides of the equation. In particular, Myers suggests that larger unfunded liabilities do not cause the market to lower the stock's value but the lack of profitability would both encourage a manager to underfund and would cause a low firm value. A parsimonious cross-sectional model, regardless of the variables, may not capture profitability adequately.

Daley (1984) also evaluated a cross-sectional model of equity valuation. The form of the model was equation (2.6) in Table 2.3, using

data for the years 1975 to 1979. Table 2.3 summarizes some of the results for 1979.

Three fundamental conclusions are reached. First, of the competing measures of pension cost; Pension Expense (PEXP), Unfunded Vested Benefits (UVB), and Unfunded Prior Service Costs (UPSC), all entered as a significant variables. Second, Daley claims that each coefficient has a theoretical value. A standard against which to compare coefficients allows Daley to assert a premier measure of pension cost in equity valuation. The theoretical values are

1. $\gamma_1 + \gamma_2 = 0$ if PC=PEXP (a dollar of after-tax pension cost has the same value as a dollar of after-tax earnings)
2. $\gamma_2 = -1$ if PC=UVB
3. $\gamma_2 = -1$ if PC=UPSC

A t-test is conducted that the coefficients meet the theoretical values. PEXP generally meets the theoretical values while UVB and UPSC do not. The year 1979 (which is shown in Table 2.3) is interesting since it is the sole year where PEXP is significantly different from theory and the t-test for UVB has the wrong sign.

In a further attempt to choose a premier measure of pension cost Daley calculates the average (of all yearly estimates) percentage absolute deviation from the theoretical value. Based on these measures the pension expense does best with a 12% measure compared to 158% and 77% for UVB and UPSC respectively. Therefore, based on two methods of ranking measures PEXP is selected as the premier measure of pension cost.

The final conclusion of Daley was that the equity valuation did not depend on the interest rate used to compute the pension expense measure.

The technique used to investigate this phenomenon was that the interest rate variable was entered as a class variable representing seven one half percent intervals of interest rate levels. The dummy variable approach is in contrast to the transformation by Feldstein and Morck. The dummy variable allows the market valuation of a particular level of pension costs, say $100, to be different depending on whether the $100 was computed using, say, a 6% interest rate or an 8% interest rate. If the market incorporates the interest rate in the equity valuation (as Feldstein and Morck suggest) the coefficient on the dummy variable did not pick it up.

One explanation for the lack of results on the interest rate is that fundamental measurement difficulties appear with this interest rate variable. For the interest rate Daley used the FASB 36 Data Base, Form 5500s, 10-ks, and annual reports. However, it is known that several interest rates are potentially used by firms. Of the 153 initial companies, Daley says single rates were identifiable for only 128. It is unlikely that Daley means a single rate for the three measures, PEXP, UVB, and UPSC were found since the rate for PEXP is not disclosed and the meaning of an interest rate may be different if drawn from the form 5500 than if drawn from the footnotes to financial statements. Therefore, if in 1978 the rate was drawn from one source and in 1979 the rate was drawn from another source, then the results of the regressions for the separate years are not comparable. Finally, even within the form 5500, two rates (possibly different) are always encoded.

In summary, these cross-sectional studies have correlated levels of firm value with levels of pension attributes. The pension attributes provide a significant explanation of firm values, and Daley claims the

existence of a premier explanatory variable of equity values. In contrast to these cross-sectional studies, Livnat (1984) evaluated the correlation between changes in equity value and changes in pension attributes. The research design used is similar to Gonedes (1978).

In order to establish the marginal importance of changes in pension attributes, the effect of earnings (say y) is controlled for. Hence, the signal x has marginal information content if

$$E(\text{Return} \mid x,y) \neq E(\text{Return} \mid y).$$

In principle, earnings, UVB, and UPSC are all relevant signals and can each be partitioned into three groups each of (H)igh, (M)edium, and (L)ow. The significance of the joint package of earnings and changes in UVB (or UPSC) was higher than earnings by itself. This indicates that the explanation of returns was improved by knowing both variables compared to knowing only earnings, though the improvement is not significant at conventional levels. Of course, with more detailed data available since SFAS 36, more partitions are possible now and represent future research. Especially, given the negative cross-sectional results of Daley, interest rates as conditioning variables for the level of change in UVB may be a useful point of investigation.

2.4 Tests of Factors Influencing Management Choice of Interest Rates

Feldstein and Morck (1983) also considered the interest rate as a management choice variable. Their theoretical considerations in selecting variables for explaining management choices are drawn from the previous arguments. That is, the average interest rate should be low since firms will generally wish to prefund. The low interest rate will cause a high unfunded liability which will allow the firm a higher

contribution. However, large unfunded liabilities are asserted to generate the following disagreeable consequences:

1. The resulting large contribution would lower earnings.
2. Limited access to credit may create a liquidity problem.
3. The large unfunded liability may be regarded by management as undesirable it itself.

It is not possible, however, to test for the effect of these consequences on management's choice of interest rates using the data of Feldstein and Morck. The fundamental problem is that each of the consequences stems from a different interest rate. Therefore, the interest rate observed determines the effect that can be examined.

Consequence one results from the interest rate used in the measurement of pension expense. A large contribution may build assets rather than lower earnings. Which effect the contribution has depends on the interest rate used to compute pension expense. This interest rate is not routinely disclosed and Feldstein and Morck did not use such an interest rate. Therefore, the effect of consequence one was tested only insofar as the Feldstein and Morck interest rate was a surrogate for the interest rate used for computing pension expense.

Consequence two results from the interest rate used to compute the required contribution. The interest rate controlling the contribution is the interest rate reported to the Department of Labor on the form 5500. It is this interest rate and the resulting contribution that affects the liquidity of the firm. This interest is routinely disclosed and thus the hypothesis is testable, but Feldstein and Morck did not use the interest rate. The effect of consequence two was tested only

insofar as the Feldstein and Morck interest rate was a surrogate for the interest rate reported to the Department of Labor.

Consequence three results from the interest rate voluntarily disclosed in the footnotes to financial statements. This interest rate was used by Feldstein and Morck; therefore, the effect of consequence three is the only argument formally tested. They found 132 companies that had disclosed interest rates in the footnotes to financial statements in 1979. These companies were the sample for a cross-sectional test of which factors were correlated with the choice of interest rates.

In order to evaluate the source of the Feldstein and Morck data, notice that the financial statement footnote data prior to 1980 was investigated by Shipper and Weil (1982). The disclosures for 1980 and later are, of course, more standardized than previous data due to SFAS 36. It is to be expected then that the disclosure of 1979 information found in the 1980 financial statements would be different from the 1979 information found in 1979 financial statements. The differences may be caused by the following:

1. The balance sheet accruals for pension liabilities were included in the 1979 liability but were eliminated from the 1980 liability, and the amount is not separately disclosed.
2. The valuation date for the 1979 liability differs from the valuation date for the 1980 liability.
3. The 1979 liability includes foreign pension plans while the 1980 liability does not, and there is insufficient disclosure to make the liability commensurate.

4. The rate for discounting future payments to present value or the assumed rate of earnings on the pension assets, or both, changed.

Therefore, the interpretation of the rate disclosed in 1979 is formally unknown. Nonetheless, for Feldstein and Morck, the cross-sectional variables to be evaluated as determinants include (see equation 2.7 in Table 2.4) PL, UAB, UVB, (Debt/A), and Bond Rating. As single variables, PL, UAB, and UVB are significant and positive. The variables (Debt/A) and Bond Rating are never significant when entered with PL, UAB, and UVB. The variables (Debt/A) and Bond Rating are not examined in isolation.

Regarding the significance of PL, UAB, and UVB there is an important consideration. Feldstein and Morck first approximately scale the pension liability to a common interest rate. Before the scaling it is known that there is an inverse relation between the interest rate and the pension liability reported by any specific company. Increases in the interest rate will lower the present value reported. Because managers may engage in strategic reporting practices, it is an empirical question whether this holds across firms.

For example, Figure 2.1 illustrates Firm B with benefits owed that are much greater than the benefits owed by Firm A. Firm B may not be able to realistically choose an interest rate high enough to lower the pension liability to the same level as Firm A. Firm A may choose discount rate X and produce present value Y. Firm B may choose any discount rate from X to X^1 and will produce a present value greater than Y. In this situation there would be a positive relation between interest rates and reported pension liabilities for the two firms.

As a second example, suppose Firm B still has benefits owed that are greater than those of Firm A. However, Firm B engages in an extreme strategy of choosing an interest rate above X^1 that actually leaves the present value of benefits lower than Firm A. In this case the relation between reported liabilities and interest rates would be negative. Finally, suppose Firm B actually makes a choice of interest rate that tends to magnify the size of reported pension liabilities such as a rate less than X. The relation between reported liabilities and interest rates would again be negative.

Therefore, the relation that is expected between reported pension liabilities and interest rates is uncertain. An extreme reporting choice in either direction will produce an observed negative relation between interest rates and reported pension liabilities. A finding of a positive relation with reported pension liabilities would be strong evidence that managers who owe greater benefits are choosing higher interest rates. However, the relation between interest rates and the reported pension liabilities is not reported by Feldstein and Morck.

The relations reported are for interest rates where the pension liability measures have been adjusted. Instead of adjusting to a variety of common interest rates, Feldstein and Morck adjust only to the average interest rate for their sample which is 7.2%. As with the valuation models, the positive relation between adjusted pension liabilities and interest rate choices are explained in two ways. The first explanation is that managers who have higher benefit levels choose higher interest rates. The second explanation is that a transformation of pension liabilities by

$$\text{APL} = \text{Reported Liability} \left(\frac{\text{REPORTED RATE}}{7.2} \right)$$

will cause a positive relation between the adjusted liability and the reported interest rate across firms for 1979 data. This adjustment may induce the positive relation since when the adjusted liability is used on the RHS of equation (2.7) in Table 2.4 the result is to have REPORTED RATE on both the LHS and RHS.

In summary, Feldstein and Morck hypothesized that three consequences drive the interest rate choices by managements. However, the interest rate used in the test is unrelated to two of the consequences and is therefore unsuitable for the test. Further, the results of the tests concerning the third consequence are explained both by the hypothesis and by the transformation made on the data.

Besides a test involving which factors enter the management choice process for levels of the interest rate, a test may be performed on changes in interest rates for firms. Morris, Nichols, and Nichaus (1983) correctly recognize that interest rates in the footnotes to financial statements are distinct from the pension expense interest rate and the funding interest rate. Recognizing this, they limit the data investigated to the footnote information in the financial statements. Limiting the source of the data to footnote information rules out testing hypotheses related to cash flow arguments.

The question of interest to Morris, Nichols, and Nichaus involves determining the causes for management to change footnote interest rates (from year to year). The hypothesis proposed is that management desires to clean up the balance sheet. This argument is similar to the Feldstein and Morck argument that management finds it undesirable to

show large unfunded liabilities and suggests that the literature perceives that management expects some negative feedback from the disclosure of an unfunded liability when that unfunded liability is different from some (correct) proportion.

The fundamental test for Morris, Nichols, and Nichaus is whether management increases or decreases its interest rate for the 1981 financial statements compared to the 1980 financial statements. They say, if firms increase interest rates then the firms are cleaning up their balance sheet.

The empirical work done is to partition firms first by whether the 1980 unfunded pension liability as a percentage of the 1980 pension assets is greater or less than zero. Second, firms are split according to whether the firms increased or decreased interest rates from 1980 to 1981. A partition by two variables results in four categories as shown in Table 2.4.

The largest average increase in interest rate is the underfunded plans. The average increase for such firms is 21.2%. Further, though not shown here, for all firms that increased interest rates, the change was negatively related to the extent of funding. No such proportional relation was observed for firms that decreased the interest rate.

In evaluating Morris, Nichols, and Nichaus, there are two limitations in considering whether the goal of explaining interest rate changes as a balance sheet clean up was met. First, no balance sheet figures were included. The incentive that makes managers desire to clean up the figures for the pension plan at some point in time is likely to be proportional to figures on the balance sheet (for example, debt) as well as stock figures off the balance sheet (for example,

unfunded liabilities). In this regard, Feldstein and Morck found no significance when testing whether levels of interest rates were related to levels of debt and Morris, Nichols, and Nichaus did not report whether debt was related to changes in interest rate for their sample. If such a desire exists, the desire to clean up the balance sheet may hinge on some other stock figures besides debt. Alternatively, a time series of rates, say changes in interest rates like in Morris, Nichols, and Nichaus, might have picked up the effect of debt where a cross-sectional test like Feldstein and Morck did not.

The second limitation of Morris, Nichols, and Nichaus is in the hypothesis itself. No manager should need to clean up the balance sheet from one year to the next simply because of the previous year's level. The manager knew before the 1980 balance sheets were released what the size would be of the unfunded liability. The manager could alter the interest rate and the unfunded liability prior to the release of the 1980 financial statement and no clean up would then be observable from 1980 to 1981. A clean up hypothesis requires that a change take place after the release of 1980 financial statements that causes the interest rate previously chosen to produce undesired proportions were it used again in 1981. Therefore, the clean up should not happen merely because of the unfunded liability shown in the 1980 financial statements.

In conclusion, no study, except Morris, Nichols, and Nichaus has even distinguished between the various interest rates. Only one study has focused on changes in interest rates, and that study looked only at the footnote disclosure. Finally, no study has correlated changes in interest rates with changes in firm attributes over time.

2.5 The Relation of this Study to Previous Literature

The current study is designed to discriminate between management decisions regarding interest rates that are concerned with cash flows and management decisions regarding interest rates that are concerned purely with disclosure.

The fundamental design is to collect the interest rates used (1) in the footnotes to financial statements for the years 1980 and 1981 and (2) in the form 5500 for the years 1979 and 1980. The levels (and changes) in the form 5500 interest rate are expected to be associated with cash flow arguments (sources and uses of funds, liquidity constraints). On the other hand, the changes in the footnote interest rate are expected to be associated with pure disclosure arguments (balance sheet clean up).

The questions regarding, first, the DOL interest rate and, second, the SFAS 36 interest rate are distinguished from other questions that can be asked. Questions still remain regarding precisely what management strategies are used in funding pension plans. This study does not directly address that question. Funding strategies and DOL reporting choices are related topics; but those topics are not identical and this study does not directly address funding strategies.

Questions remain regarding interest rate choices for purposes of recording expense. This interest rate is not disclosed and though either the DOL interest rate or the SFAS 36 interest rate may be a surrogate for the interest rate used for purposes of expense, this aspect is not the object of a direct test.

Questions remain regarding the impact of funding and reporting choices on claimants to the firm. Such questions, though interesting, are beyond the scope of this dissertation.

Table 2.1

TESTS OF INPUTS TO
MANAGEMENT'S FUNDING DECISIONS
(t statistics are in parentheses)

Friedman (1982):

$$\frac{PL - PA}{NW} = \underset{(10.1)}{\alpha + .14 \frac{BL}{NW}} \qquad (R^2 = .07) \qquad (2.1)$$

$$PAE/A = \underset{(58.1)}{\alpha + .31 (PA/A)} \underset{(-2.5)}{- .29 (\sigma_{EBIT})} \qquad (2.2)$$

$$PA/NW = \underset{(42.8)}{\alpha + .60 (PL/NW)} \underset{(-4.9)}{- .06 (BL/NW)} \qquad (R^2 = .59) \qquad (2.3)$$

Francis and Reiter (1984):

$$PA/PL = \underset{(1.69)}{1.04} + \underset{(-.092)}{.359 \text{ TAX RATE}} - .012 \text{ ASSET VARIABILITY}$$
$$\underset{(-.602)}{- .002 \text{ BENEFITS TO EQUITY}} \underset{(-4.287)}{- .013 \text{ BENEFITS PER EMPLOYEE}}$$
$$\underset{(-1.432)}{- .329 \text{ DEBT/EQUITY}} + \underset{(1.285)}{.022 \text{ SIZE}} \underset{(-.856)}{- .004 \text{ INTEREST COVERAGE}}$$
$$+ \text{INDUSTRY DUMMY} \qquad (R^2 = .19) \qquad (2.4)$$

Note: Definitions are given in Table 2.2

Table 2.2

DEFINITIONS FOR VARIABLES USED IN CHAPTER TWO TABLES

σ_{EBIT} is the variability of accounting earnings.

A is the size of corporate assets.

APL is the size of the pension liability after adjusting for interest rate differences

BL is the corporate book liabilities.

E is the accounting earnings.

EBPC is the earnings before pension cost.

G is the growth in accounting earnings.

NW is the corporate net worth.

PA is the pension assets.

PAE is the amount of pension assets invested in equity securities.

PC is the pension cost.

PL is the pension liability.

RD is the research and development expense.

UAB is the unfunded accumulated pension liability.

UVB is the unfunded vested pension liability.

UPL is the unfunded pension liability.

V is the market value of corporate assets.

VB is the vested benefits.

Table 2.3

MARKET VALUES AND FUNDING STRATEGIES

Feldstein and Morck (1983):

$$V/A = \alpha_0 + \alpha_1 E/A + \alpha_2 G + \alpha_3 RD/A + \alpha_4 BETA + \alpha_5 DEBT/A + \alpha_6 UVB/A + e \quad (2.5)$$

Estimation Results for UVB/A

Variable		Inflation Adjusted	Historical Cost
UVB	t	1.74	2.83
	r^2	.51	.68

Daley (1984):

$$V/A = \gamma_0(1/A) + \gamma_1(EBPC/A) + \gamma_2(PC/A) + \gamma_3(RISK\ ADJUSTMENT) + \gamma_4(G/A) + e \quad (2.6)$$

PC	PEXP	UVB	UPSC
γ_2	-12.02	-2.99	-1.95
(t)	- 4.17	-4.40	-4.43
t-test of theoretical value	- 2.14	2.93	-2.16

Table 2.4

INTEREST RATES DETERMINANTS

Feldstein and Morck (1983):

$$\text{REPORTED RATE} = \alpha_0 + \alpha_1 \text{ (APL/A)} + \alpha_2 \text{ (UVB/A)} + \alpha_3 \text{ (UAB/A)} + \alpha_4 \text{ (Debt/A)} + \alpha_5 \text{ (Bond Rating)} + e \qquad (2.7)$$

Morris, Nichols, and Nichaus (1983):

	Underfunded in 1980	Overfunded in 1980
Increase in Rate	21.2% Increase	18.6% Increase
Decrease in Rate	14.6% Decrease	12.8% Decrease

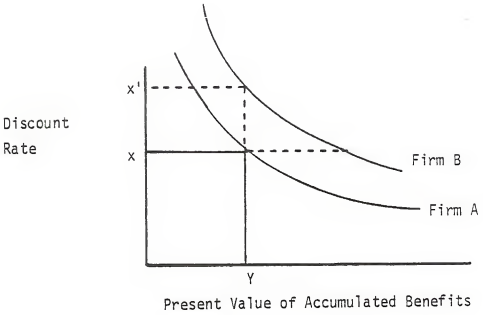
Discount
Rate
x'
x
Firm B
Firm A
Y
Present Value of Accumulated Benefits

Figure 2.1

CHAPTER III
THEORY AND HYPOTHESES

3.1 Introduction and Assumptions

It is evident that a description of the environment in which the manager makes decisions influences the subsequent development of hypotheses. The model environment consists of an exogenously imposed linear incentive function, and linear utility function for the manager. The model allows the manager to select an optimal response to the environment, subject to certain constraints. The response variables are (1) the DOL interest rate, (2) the pattern of contributions, and (3) the FASB interest rate. The chapter is organized so as to present the model in section 3.2. The hypotheses are discussed in section 3.3.

The model generates particular relations (or hypotheses) between response variables and the environment. The model is a statement of certain sufficient conditions for the relations to exist. No effort is made to identify necessary conditions. Further, the impact of deviations of actual environments from the assumptions remains an empirical issue.

Section 3.2 describes the manager's problem. Certain assumptions are important for ease in developing the theory. Some of the assumptions are arbitrary, rather than descriptive, but the conclusions are robust with respect to some alternatives. The most significant assumptions are introduced as part of this section. Sensitivity to the assumptions is also discussed.

In order to make the arguments salient and understandable, a simple model is used of a management that maximizes the present value of corporate assets net of pension costs. At least two central assumptions are made initially in order to generate the hypotheses.

1. The total capital available is fixed or the debt capacity is fixed.
2. The management's utility has as its only argument the present value of assets (or owner's equity as relevant) net of pension costs. The manager utility is linear in the argument.

Section 3.2 deals formally with the manager's decision problem. However, a manager with utility $U(V_0)$ where $U'>0$ and $U''=0$ creates a risk neutral manager. For certainty, it suffices to solve the problem

$$\text{Max } V_0 = A_0 - \sum_{t=0}^{T} \frac{B_T}{[1+r_a(1-\tau)]^t (1+r_p)^{T-t}} \qquad \left[\begin{array}{c}\text{Comprehensive}\\ \text{Problem}\end{array}\right]$$

C_t, R_t, I_t

$$\text{s.t.} \quad \text{minp}(R) \leq C_t \leq \text{maxp}(R) \qquad \text{(c1)}$$

$$\sum_{t=o}^{T} C_t(1+r_p)^{T-t} = B_T \qquad \text{(c2)}$$

$$C_t \leq A_t - K_t \qquad \text{(c3)}$$

$$PR_t = B_T/(1+I)^{T-t} \left(\sum_{k=0}^{t} C_k(1+r_p)^{t-k}\right) \geq L_t \qquad \text{(c4)}$$

$$I \varepsilon I' \qquad \text{(c5)}$$

$$R \varepsilon X \qquad \text{(c6)}$$

where V_0 is the after pension cost value of the firm at time 0,

C_t is the contribution to the pension fund in period t,

minp(R) is the regulatory minimum payment, and is a function of the expectation, R, that management reports to the DOL,

maxp(R) is the maximum regulatory payment and a function of the same level of R as minp,

r_p is the actual market return on pension fund assets,

B_T are the benefits due to be paid at the decision horizon of the firm, T,

A_t are the corporate assets available at time t, and,

K_t is the most binding liquidity constraint on the firm at time t,

X is the set of DOL acceptable rates,

I' is the set of SFAS 36 interest rates acceptable to the auditor, and

I is the SFAS 36 interest rate.

It is discovered that because, in general, the return on the pension assets is different from the return on corporate assets, the schedule of contributions is a determinant of V_0. It is this schedule of contributions that is the primary decision variable for the manager. However, in the Comprehensive Problem there are

(a) nominal regulatory bounds on the contribution, constraint (c1), and

(b) general contractual bounds on the use of assets by the manager, constraint (c3).

These bounds possibly obstruct the value maximizing schedule. The solution procedure will evaluate the impact of each constraint in turn.

With respect to the first constraint, the nominal regulatory bounds on the contribution, the second decision variable that the manager controls is the firm specific input to the regulatory bounds; the manager chooses his own DOL interest rate which is the "expected" rate of return, R. The manager can use R to modify those bounds and achieve the value maximizing schedule of contributions. Formally, there probably exists additional bounds on the choice of R (constraint (c6)) that would provoke a response by the IRS or the DOL were it exceeded.

The third constraint arises from debt contracts. Debt contracts fix repayment schedules and sometimes provide bounds on the debt to equity or working capital for firms where debt, equity, and working capital are determined by GAAP accounting. Such constraints can have an impact on funding decisions, since transfers to the fund, in general, are reductions in the sponsor's GAAP assets rather than changes in the asset mix. Such reductions in GAAP assets move the debt to equity ratio closer to the bound. However, to the extent the transfer of assets is in excess of the GAAP maximum for expenses, the excess does not reduce total assets.

These constraints also have an effect as the sponsor gets close to their limiting value; the constraints need not be actually binding in order to influence the manager. For example, suppose the returns to assets (corporate and pension) are uncertain. As any particular debt covenant constraint tightens, the probability of violating the constraint rises for some periods which enhances the importance of this constraint. As C_t increases, the remaining assets $A_t - C_t$ have an

increased probability of violating the constraint in the next period, which lowers the value of the equity.

In any extension to uncertainty of returns, the impact of the covenant is to lower the contribution made. In effect, the covenant increases the value of keeping assets in the firm. Assumptions of risk neutrality and risk aversion produce similar hypotheses for the manager. Risk aversion merely magnifies the value of being liquid. Likewise, divergence between owners and managers as regards production and risk sharing decisions are not likely to change the effect of the debt covenant constraint, only the magnitude.

Overlaying the manager's relation with the DOL and creditors is his relation to labor. Part of that relation to labor is constraint (c4). The pension plan is an element of the compensation package of employees. Like creditors, employees do not rely on implicit or repeated play situations to guaranty the delivery of the promised cash. While creditors use covenants and sinking funds to guard against unwanted actions by management, employees depend on firms' irrevocable contributions to a pension trust fund. Contributions irrevocably made to the pension fund insure the employee against defaults on the benefits. Smaller contributions lower the value of the pension element of the compensation package. A compensation package below the alternative wage rate would put the firm out of business. Therefore, a minimum bound constraint (c4) exists on the funding of the pension plan.

Finally, constraint (c2) formally requires that the budget of contributions is sound. This requirement is not severe. The budget may call for totally prefunding the plan, thus lowering the risk to labor. Or, it may alternatively call for a terminal funding pattern, enhancing

the risk to labor. In either setting, constraint (c2) insures that the contribution fully meets the benefits if the budget is carried through. Any choices made must be plausible only in the sense that they could be part of a plan that would meet B_1. Constraint (c2) simply insures that the choices are part of such a plan.

3.2 Manager Decisions

Assumption 2 says that any interest the manager has in the pension plan for himself is distinctly small compared to the objective of maximizing the value of the firm. The manager's utility is $U(V_0)$, where V_0 is the value of the firm assets net of pension costs at time 0. A more general development would include the impact of the pension plan on the manager's utility. The compensation of some managers is, in part, current payments, and, in part, deferred compensation. If that issue were significant, the utility would need to incorporate the value of the pension plan. This problem is excluded from consideration here. Logue (1980) argues that if the incentive exists, and managers operate on it, bonding and monitoring costs rise. These costs should approximately offset the incentive rendering the impact of this argument on the manager's utility small. The dissertation assumes that any such incentive problem is solved outside the current setting.

The manager's problem is therefore to maximize the value of the firm. Once the level of available assets is determined, the manager's problem is to maximize the value of the firm after pension costs. Following assumption 1 this amounts to an allocation of capital between the pension fund and the corporate assets. Following assumption 2 it suffices to use the value of the assets after pension costs as the objective function.

To find such a value, assume a corporation with assets at time 0 equal to A_0 has a contribution of C_0 immediately due to its pension fund. The corporate assets after the contribution will earn a return of r_a for the first period on which a tax will be paid of rate τ. The corporate assets at the beginning of time 1, before any more contributions are made, have grown to $A_1=(A_0-C_0)[1+r_a(1-\tau)]$. Extending this process for T periods produces assets of

$$A_T = A_0[1+r_a(1-\tau)]^T - C_0[1+r_a(1-\tau)]^T \ldots - C_T[1+r_a(1-\tau)]^{T-T}$$

Discounting A_T back to time 0 at the discount factor $[1+r_a(1-\tau)]^T$ produces

$$\frac{A_T}{[1+r_a(1-\tau)]^T} = A_0 - \sum_{t=0}^{T} \frac{C_t}{[1+r_a(1-\tau)]^t} = V_0 .$$

Or, the present value of the assets available at the decision horizon is equal to the current assets available less the present value of contributions discounted at the corporation's after tax rate of return.

The cost of the pension plan has also been shown by Feldstein and Seligman (1981) in the following way. Let ${}_tB_T$ be the amount of benefits paid to beneficiaries at time T and funded at time t. Let r_p be the true return on the fund assets per period. The contribution at time t, C_t, to fund ${}_tB_T$ would be

$$C_t = \frac{{}_tB_T}{(1+r_p)^{T-t}} \quad . \qquad (1)$$

The contribution C_t has a future value of ${}_tB_T$ after compounding at a rate r_p for T-t periods.

The amount, ${}_tB_T$, describes the benefits that are funded at time t. The amount, ${}_tB_T$, is not the benefit rights that accumulate to the employee in time t. The amount, ${}_tB_T$, is frequently larger (1) because

pension plans may grant credit to work done prior to implementing the plan, and (2) because amendments (typically increases) sweeten the plan. Thus, plans start out with unfunded prior service costs and amendments may add to the unfunded costs; as a result, annual contributions would have to be larger than the cost of currently accumulating benefits to catch the funding up to meet the prior service costs as due.

The amount required at time 0 in the firm in order to make the contribution, C_t, at time t depends on the return being made by the corporate assets. As before, suppose corporate assets produce r_a and the tax rate is τ. This gives a periodic return of $r_a(1-\tau)$. A time 0 current cost to the firm, equivalent to C_t at time t is denoted PVC_t. PVC_t is the size of assets in the firm at time 0 that would compound up to the amount required to make the contribution at time t. PVC_t is the present value of the contribution discounted at the firm's net of tax rate of return or

$$PVC_t = \frac{C_t}{[1+r_a(1-\tau)]^t} = \frac{{}_tB_T}{[1+r_a(1-\tau)]^t\,(1+r_p)^{T-t}} \quad .$$

The only actuarial requirement on the time pattern for C_t relates to the total benefits to be paid at time T. These total benefits to be paid must be funded at some time t, $0 \leq t \leq T$. Only the benefits so funded will be paid (i.e. $\sum_{t=0}^{T} {}_tB_T = B_T$ = total benefits paid). In turn, the present cost of the pension plan is the sum of the present cost of the benefits paid.

$$PVC = \sum_{t=0}^{T} PVC_t = \sum_{t=0}^{T} \frac{C_t}{[1+r_a(1-\tau)]^t} \qquad (2)$$

Note that the cost depends on (1) the benefits, (2) the relative return on the pension assets ($(r_a - r_p$ and $\tau)$, and (3) the funding pattern.

The value of the assets, net of pension costs, V_0, is then the present value of the assets less the (tax adjusted) cost of the pension plan:

$$V_0 = A_0 - PVC \qquad (3)$$

As V_0 becomes larger, management is better off. And, since shareholders and creditors have a congruent interest in the size of V_0, as V_0 is larger, shareholders and creditors are better off.

So far, however, there are no decisions for management to make. Everything has been taken as predetermined (including the funding pattern). However, in actuality, management has control over certain decisions variables, mindful of certain regulatory constraints. The variables include the pattern of funding (C_t, for $0 \leq t \leq T$) and the interest rate reported for computation of the minimum payment and maximum payment where control of the reported interest rate expands control over the pattern of funding. The next sections illustrate the management problem and the constraints on their activities.

3.2.1. Funding pattern as a choice variable subject to labor based constraints

This section explains the actuarial requirement that all the benefits are funded sometime and describes the value of discretion in the funding pattern. That all the benefits are funded sometime prescribes that any contribution made be part of a plausible funding pattern that would meet the benefits as due. The value of discretion in funding discussed here deals primarily with the arbitrage implications of funding a pension plan.

The arbitrage implications of funding relate purely to the tax effect of prefunding the benefits. Such implications are independent of risk considerations to labor and firm claimants, though risk considerations are important. Less assets in the firm because of a high contribution leave less cushion and more risk for creditors. Less assets in the pension fund leave less cushion and more risk for beneficiaries. The risk issue for labor will be addressed in this section. The risk for creditors will be addressed in Section 3.2.2.

Management has some latitude in its choice of C_t for $0 \leq t \leq T$. Within certain constraints, management may choose a pattern of payments that maximizes the spread illustrated in equation (3). Frequently, management uses an actuarial cost method to plan and implement the payments. However, consider first some extreme patterns.

In general, the cost of alternative funding patterns is not identical. Thus, management has certain choices to make that change the value of the assets, net of pension costs. For example, a terminal funding pattern would produce a cost of the pension plan of

$$PVC = \sum_{t=0}^{t} \frac{{}_tB_T}{[1+r_a(1-\tau)]^t(1+r_p)^{T-t}} = \frac{B_T}{[1+r_a(1-\tau)]^T} \qquad (4)$$

On the other hand, fully pre-funding the pension plan would produce a cost of

$$PVC = \sum_{t=0}^{t} \frac{{}_tB_T}{[1+r_a(1-\tau)]^t(1-r_p)^{T-t}} = \frac{B_T}{(1+r_p)^T} \qquad (5)$$

Management's role is to choose which funding pattern to use, and that decision will affect V_0 in equation (3). The management's problem then is

$$\underset{C_t}{\text{Max}} \quad V_0 = A_0 - PVC(C_t) \qquad \text{(Limited Problem)}$$

$$\text{s.t.} \quad \sum_{t=0}^{T} C_t(1+r_p)^{T-t} = B_T$$

This Limited Problem is a reminder that the choice of funding pattern is part of the management process. The impact of the funding pattern depends on the relative returns, r_a and r_p, and the tax rate to which the firm is subject.

Once management's valuation problem is stated, certain elements about labor's decision process can be described. Labor has a disutility for disruption in wages. The sources of disruption are from (i) the firm terminating employment during the employee's working life and from (ii) non-payment of pension benefits after the employee's working life.

The first mentioned concern generates an upper bound on what labor can demand for funding their pension plan without disrupting current wage security. Labor would not push a demand past the point of losing their current employment. The amount labor would look at to determine a maximum bound on demand would be the most binding constraint on management's use of capital, K.

The second concern places a lower bound on the amount that can be funded and places a value on increases in funding the pension plan. The lower bound on funding is where the current wages plus change in the value of the pension plan is less than the alternative wage rate. Increases in funding the pension plan are valued because the increased funding makes more likely the chances that the pension benefits will be paid.

Labor is the primary interested party in having a well-funded pension plan. The tools that labor has to implement the demand for

increased funding include alternative employment, work slow downs, strikes, and other disruption. Other parties interested in well-funded plans besides labor are labor allies like regulatory agencies, Congress, and journalists. Possible sanctions that the other interested parties can impose on the firm include audits, court cases, increased regulations, and exposés that disrupt strategic planning and day to day operations. Any disruptive condition labor or other parties can impose that would take the rent away from management is a tool to shift the compensation package upward.

This value that labor ascribes to increases in funding is the result of comparing the pension benefits and the expected return to the pension fund assets to the amount of pension fund assets currently on hand. As the level of pension assets increases this ratio falls and the security of the benefits is enhanced. Further, as the return to the pension assets increases the benefits are more secure.

The management's report of the comparison of pension benefits takes the form of

$$PR_t = B_T/(1+I)^{T-t}\left(\sum_{k=0}^{t} C_k(1 + r_p)^{t-k}\right)$$

or

$$PR_t = B_T/(1+I)^{T-t}\ PA_t\ .$$

In words, PR is the ratio of benefits, discounted at the rate I, to the current level of pension assets. The current level of pension assets, in turn, is the result of previous contributions and returns to those previous contributions.

The negotiating position by management and labor will each incorporate PR in some fashion. The production and consumption of PR need not

be simple, however. Management, while not in control of B_T which is set by contract (and thus verifiable), or T, which is set by actuaries, is in control of I. The footnote rate, I, is not verifiable until significantly after the disclosure. The footnote rate, I, is also not the special province of the actuary. The manager's skill is, in part, to make correct asset allocations and thus has a comparative advantage in the estimation of returns over the actuary. Therefore, while several parties may use the PR implied in financial statement disclosures, the management has control, in some degree, over the level through management's control of I.

The only bound the manager has on selection of I is the attestation process. The auditor is assumed to review the evidence and place bound on what I may be reported. The set of I that would produce an unqualified opinion is

$$I \in I'.$$

Therefore the manager has some, but not complete, control of PR. In order to minimize the effective use of PR by labor or labor's stand-in, the manager will set PR at the upper bound allowed by the auditor.

However, not just any C_t that satisfies the actuarial constraint and labor demand constraint is feasible. ERISA, tax laws, and natural constraints restrict the funding pattern as the next section explains.

3.2.2 Additional constraints on the funding pattern

There are three additional important constraints on the pattern of funding. The first comes from the natural restriction that the management cannot contribute what the management does not have, the second and third come from ERISA.

The first constraint on the management choice of funding is simply that the manager cannot fund more than is available. The contribution C_t cannot be greater than A_t. This defines a constraint on the maximum contribution. Similar to a large dividend, if the contribution equals the assets, the firm would essentially go out of business. Further, even contributions of a size dramatic in magnitude compared to the assets available may permanently impair the ability of the firm to operate. Such impairment could come from several sources.

One source of impairment could be from the minimum capital to labor ratio required by existing technology in an industry. Reductions in capital lower the capital to labor ratio. Contributions of an excess amount that would drop capital too low could put the firm out of business. A second source of impairment may be pre-existing contracts. Debt covenants and credit agreements frequently contain provisions restraining certain management decisions. These provisions may include limitations on (1) debt to equity ratios, (2) working capital minimums, and (3) the extent of dividends to be paid. Large contributions compared to the size of equity or working capital could result in defaults on the source of credit.

The prior contractual constraints may exist for a variety of reasons. For example, management may have raised funds in the past from creditors who explicitly set limits on (relatively) large transfers of cash out of the firm since transfers out of the firm are difficult to recover in the event of bankruptcy. Even though the returns to corporate assets may not be as great as the returns to the pension fund, the difficulty of recovering pension fund assets by creditors (if it were

possible to recover at all) would suggest that creditors restrict the amount of assets transferred out of the firm.

Such a covenant, written as part of a creditor's contract, could require a level of assets in the firm each period, denoted K_t. For a level of assets in period t, A_t, the contribution without violating the covenant, must satisfy

$$C_t \leq A_t - K_t. \qquad (6)$$

Hence, relation (6) sets a maximum level of C_t. Trivially, if period t is the date of maturity of debt, then K_t is the principle amount of such debt. Thus, in this constraint, K_t represents the most binding covenant, principle due, debt service amount, or minimum capital amount for the period considered.

When returns are uncertain, the bond holder can suffer a higher risk from the irrevocable transfer. For example, a large pension contribution reduces the remaining corporate assets, leaving the firms less flexible than the firm would otherwise be. For uncertain returns there is value to a creditor in having assets where the assets can be more easily retrieved by the creditor. In turn the creditor should provide an incentive for management to hold assets out of the pension plan. This incentive for creditors operates as the management merely nears a setting where there is a smaller solution space to the funding problem. Before the solution space actually disappears, management has an incentive to begin looking for the lowest cost constraint to alter.

To illustrate this effect more fully, a contribution in period t, C_t, leaves the firm with fewer assets with which to (1) operate and (2) meet minimum pension payments and debt obligations in subsequent

periods. That is, C_t affects the probability of inequality (7) being met. Violation of the feasible region at a time j periods after t implies

$$A_{t+j} < \text{minp}(R)_{t+j} + K_{t+j}, \qquad (7)$$

which implies a default on fixed claims. When this probability of default in j periods after t is sufficiently high, management has an incentive to lower the current contribution and retain assets in the firm.

The probability of default some j periods subsequent to t given a current contribution C_t, is denoted as

$$\Pr\{\text{default}_j\} = \Pr\{A_{t+j} < K_{t+j} + \text{minp}(R)_{t+j} \mid C_t\}.$$

Management evaluates this probability for all C_t, for all j periods up to the decision horizon, $0 \leq j \leq T-t$. The main effect of increases in C_t is to cause an increase in the probability of default. To see this consider the following arguments. Increases in C_t lead to lower $\text{minp}(r)_{t+j}$ and lower corporate assets, A_t. In words, increasing contributions leads to lower required pension contributions in subsequent periods (lower $\text{minp}(R)_{t+j}$) and to lower corporate assets at the time of the high contribution. Increases in C_t, in general, will not change K_{t+j}.

The future minimum contributions, $\text{minp}(R)_{t+j}$, however, are not affected as much might be supposed, since $\text{minp}(R)_{t+j}$ was essentially discretionary to begin with. As future discussion will show, control of R leads to control of $\text{minp}(R)_{t+j}$. The variable $\text{minp}(R)_{t+j}$ (sometimes termed the debt service equivalent of the pension plan) can be altered

as desired; therefore the effect on $\text{minp}(R)_{t+j}$ of C_t is small. The main effect of C_t is, consequently, on A_{t+j}. For at least some probability assessments, the effect of increases in C_t is to raise the probability of default over some future periods. That is, the causality runs as follows:

$$\uparrow C_t \rightarrow \downarrow A_{t+j} \rightarrow \uparrow \Pr\{\text{default}\} .$$

In such circumstances, a sufficiently high probability dictates funding at the minimum regardless of other arguments.

The next pair of constraints is that there is a minimum and maximum amount of contributions that must be made by law.[1] The minimum can be described as an amount that covers at least the current accumulations of benefits (to be paid in the future), i.e. the normal cost, plus an effort to fund any unfunded past service costs (UPSC) over a set of years given by the regulations. The regulations' intent was to ensure that benefits that were unfunded in the past were eventually caught up. The unfunded past service costs are to be funded over a maximum of 40 years if the plan was begun before January 1, 1974, and they must be funded over a maximum of 30 years if the plan was begun after January 1, 1974. Any amendments are to be funded over 10 years.

Thus, the minimum can be shown as

$$C_t \geq \text{Minimum Payment} = \text{Normal Cost} + \text{Amortized cost}$$
$$= \text{minp}(R). \qquad (8)$$

Relation (8) says the minimum payment is the normal cost of the plan plus an annuity payment for the UPSC. The annuity is an amount such that it will fund the UPSC created on a certain date when made over the legal maximum period. The determination of the normal cost and annuity payment is the joint decision of management and the actuary for

regulatory reporting purposes where the minimum payment depends on the reported interest rate.

In contrast to the management's determination of the minimum payment by setting R in relation (8), relation (3) describes the management's (or the owner's or the creditor's) determination of PVC by assessing r_p. The assessment of r_p and the reporting of R do not have the same motivations since different decisions are contemplated. The interest rates, r_p and R, are, consequently, likely to be different.

The next constraint of this section is the maximum contribution that is tax deductible. Section 404(a)(1) of the Internal Revenue Code describes the maximum contribution that is tax deductible. The maximum contribution has the same form (with some exceptions) as the minimum payment except that the UPSC is amortized over 10 years rather than 30 years. Notationally, the constraint can be described by

$$C_t \leq \text{maxp}(R). \qquad (9)$$

The information used in the form 5500 is the documentation for the pension deduction on the corporate tax return. The examiners of the form 5500 routinely reconcile the corporate deduction with the Funding Standard Account entries. Variances are investigated. Auditors of corporate tax returns have the form 5500 available as a substantive test of the deduction. Therefore, there is an enforcement mechanism that assures compliance with relations (8) and (9).

Besides the enforcement mechanism, there are two additional features of the relation between form 5500 disclosures and the regulatory constraints worthy of noting. As previously described, the actuarial assumptions are required to be the same for both minimum and maximum computations. This has small practical impact here since a company is

mostly interested in moving the constraint it is bumping into rather than constraints which are not binding. A second feature of the maximum constraint is that a firm can contribute more than the maximum in any year; it is only the tax deduction that is limited. Any currently excess contributions can be taken as deductions in subsequent years. The model is simplistic in this regard. There is, technically, no upper bound on the contributions. There is only an upper bound on the tax deduction. The model binds management to contribute only what is deductible. As an alternative, C_t can be redefined as contributions that are deductible, with consequent impact on the model and analysis.

The imposition of the additional constraints means that the value of the objective function in problem (I) is less than or equal to the value without the constraints. The imposition means (1) that problem (I) is no longer an apt description of the management problem and (2) that the interest rates used for reporting are important choice variables. The management problem has evolved into the following constrained maximization problem:

$$\underset{C_t,\ I,\ R}{\text{Max } V_0} \qquad \text{Comprehensive Problem}$$

s,t,

$$\min p(R) \leq C_t \leq \max p(R) \tag{c1}$$

$$\sum_{t=0}^{T} C_t(1+r_p)^{T-t} = B_T \tag{c2}$$

$$C_t \leq A_t - K_t \tag{c3}$$

$$PR_t = B_T/(1+I)^{T-t} PA_t < L_t \tag{c4}$$

$$I \in I' \tag{c5}$$

$$R \in X \tag{c6}$$

That management supplies some of the inputs to the constraint has already been explained and this provides incentives in reporting that are elaborated on in the next section.

3.3 Hypotheses

Hypotheses are now derived about management choices of DOL and SFAS 36 interest rates (R and I respectively). The hypotheses for R are developed based on the impact of R on the regulatory funding constraints (c1). The hypotheses for I are developed based on the impact of I on the unfunded liability (PR) shown in the financial statements (c4).

First, suppose $r_a(1-\tau) > r_p$ is the case. This can be the situation when the management periodically has unusual opportunities for investment. If management has such opportunities then they would like to leave a sufficiently large amount of assets in the company. That is, the relative returns between corporate and pension assets drives the funding decision to some extent. The difference between the returns on

the corporate assets and the returns on the pension assets can be denoted as follows:

$$CAPEXP = r_a(1-\tau) - r_p \tag{10}$$

When the difference shown in equation (10) is positive, the variable CAPEXP shows the return lost by contributing a dollar to the pension plan trust. In order to minimize the cost of the pension plan when CAPEXP is positive, the company needs to reduce funding and expand the capital inside the company, hence the term CAPEXP.

Recall that equation (4) gives the cost of a plan under a terminal funding pattern and equation (5) gives the cost of a plan where the plan is fully prefunded. IF CAPEXP > 0, then

$$\frac{B_T}{[1+r_a(1-\tau)]^T} < \frac{B_T}{(1+r_p)^T} \tag{11}$$

or, terminally funding a plan is lower cost than prefunding. The closer to terminally funding a plan management can get, the better off they are. The model presents a relation between changes in CAPEXP and changes in PVC. Consider r_p and τ to be fixed.

With the minimum payment as a binding constraint, the value to the decision maker of lowering the minimum payment is positive and a function of the relative returns, CAPEXP. The minimum payment (c1) can be lowered by choosing a higher R. The first hypothesis is therefore that higher (relative) returns in the corporate assets will lead to a reduction in pension plan funding and cause higher levels of R.

This hypothesis is seen from the model by first observing that from equation (2)

$$\delta PVC/\delta C_0 > 0 \tag{12}$$

when CAPEXP > 0. Further, since expression (12) encourages firms to fund at the legal minimum (given R) this minimum funding is replicated by

$$C_0 = minp \tag{13}$$

where $$\delta C_0/\delta minp > 0. \tag{14}$$

The model then states

$$d\ PVC = (\delta PVC/\delta C_0)(\delta C_0/\delta minp)(\delta minp/\delta R)\ dR + (\delta PVC/\delta\ CAPEXP)\ d\ CAPEXP. \tag{15}$$

Rearranging equation (15) gives

$$dR/d\ CAPEXP = \frac{d\ PVC/d\ CAPEXP}{(\delta PVC/\delta C_0)(\delta C_0/\delta minp)(\delta minp/\delta R)} - \delta PVC/\delta CAPEXP),$$

with the signs on the arguments of

$$dR/dCAPEXP = \frac{(-)}{(+)(+)(-)} - (-) = (+)$$

In summary, increases in CAPEXP lead to increases in R, according to the model. The first hypothesis can be stated as

R-H1: The choice of R is directly related to CAPEXP.

The second hypothesis states that lower levels of liquidity will prevent the firm from liberally funding the pension fund, leading to higher levels of R. This results from a potential conflict between the liquidity constraint (c3) and the regulatory constraint (c2). For example, when very little cash is available to fund the pension plan, the company will minimize the contribution to the pension plan. Further, if the contribution so chosen nominally violates the regulatory minimum funding standard, the company can easily choose a new, higher R that lowers the minimum payment.

The model generates the hypothesis in the following way. When

$$minp > A_0 - K_0$$

at the current level of R, constraints (c3) and (c2) prevent the existence of a feasible region. However, by the discussion surrounding expression (8),

$$\delta minp/\delta R < 0$$

and so management can easily choose a new, higher R that allows a feasible region. Even before the constraints conflict, management desires a cushion of liquidity in its assets and will therefore begin to keep money away from its contribution to the pension trust. The amount of liquidity, LIQ, is denoted

$$LIQ_0 = A_0 - K_0 .$$

Then when nominal constraints (c3) and (c1) appear to conflict, the company has R available to change c1 and will set

$$minp = A_0 - K_0 = LIQ_0$$

and $$dLIQ_0 = (\delta minp/\delta R)\, dR$$

or $$dR/dLIQ = 1/(\delta minp/\delta R) < 0 .$$

The second hypothesis can be stated as

R-H2: The level of R chosen is inversely related to LIQ.

The third attribute management looks at when choosing the level of funding is the current level of accumulated benefits compared to the current pension assets. Where the comparison is by ratio, the result is termed a pension ratio (PR) in this dissertation. Two forces operate against each other in determining the net impact of PR on the management's choice of current funding and hence DOL interest rate. The first force on management is from labor. The second is from creditors and owners.

The first force to operate on management (because of PR) is the demand by labor. Labor desires a well-funded plan. A management that

chooses to poorly fund a plan receives higher demands from labor. Faced only with this first force the third hypothesis would be that a poorly funded plan calls for an upward adjustment in the level of funding. That is, a plan that was historically a poorly funded plan (i.e. a high PR) would choose a low DOL interest rate so as to increase funding. In general, and in the absence of other forces, management will supply the demanded funding (to appease labor).

However, there is a countervailing second force. This force, operating against labor's demand, comes from creditors and owners. Creditors and owners will insist, to the extent possible, that labor bear a portion of the risk of the firm. Creditors and owners bear less risk and labor bears more risk when a lower contribution is made. The opposing forces from creditors and owners versus labor battle to equivalent magnitudes (at the margin) in order to determine the size of PR.

The previous discussion concludes that the PR of any plan is the result of the forces of labor working against the forces of owners and creditors to arrive at the extent to which the plan is funded. Where there is no evidence that the balance of forces has changed, the same degree of funding can be expected to continue. For example, suppose that management knows the 'true' normal cost but the forces have settled at a degree of funding that is 80% of benefits that accrue each year. Management can 'manufacture' a normal cost at 80% of the size of true normal cost by choosing a high DOL interest rate. From year to year the proportion of benefits covered by assets would be constant and the PR ratio would be constant.

The variable PR, then, describes the place where the force of owners and bond holders have 'equalized.' Where the forces have settled

at underfunding (overfunding), the DOL interest rate can be used to implement the underfunding by being set high (low). The third hypothesis therefore states that when the PR ratio is high, the DOL interest rate will be high.

The model presents this conflict between forces as a potential conflict between the constraints (c3) and (c4). Labor demands (and can enforce) a lower bound on compensation during the current year. The lower bound is that current wages plus the expected value of pension benefit accruals exceed the alternative wage rate. The lower bound can be summarized by constraint (c4).

Creditors and owners demand (and can enforce) a lower bound on liquidity. The lower bound on liquidity is described, as before, by constraint (c3). Where constraints (c3) and (c4) conflict,

$$L_0 \geq LIQ_0$$

the firm would not be able to function; there is no feasible region.

Now, suppose the constraints allow a solution. Even though a solution is formally possible, both labor and creditors each desire their own claims to be as safe as possible.

In whatever manner the risk is shared between labor and creditors, the choice of R is made to reflect that sharing. As PR is higher, less funding is required to maintain the level of PR and R will be higher. As PR is lower, more funding is required to maintain the level of funding and the level of R will be lower. The third hypothesis regarding R can be stated as:

R-H3: The choice of R is directly related to PR.

In the summary of the hypotheses for R (Table 3.1), certain critical inputs to the regulatory constraints are reported by management.

In particular, the computation of the minimum (maximum) payment is sensitive to choices of R, and it is obvious that increasing (decreasing) the reported interest rate lowers (raises) the regulatory minimum (maximum) payment. Thus, when a funding level is chosen that incorporates the forces of (1) returns, (2) liquidity, (3) risk sharing between creditors and labor, the choice of R is made so as to include the desired funding level in the feasible region.

The next pair of hypotheses relate the management's choice of the SFAS 36 interest rate to other variables. The first hypothesis is that the management's desire to minimize an undesirable response to the financial statements leads them to produce the lowest possible level of unfunded liability. The first hypothesis for I is stated as:

I-H1: The level of I chosen is directly related to PR.

The model presents a somewhat trivialized representation of this effect. Constraint (c4) sets a bound on the PR of a company by the expression

$$PR_0 = B_T/(1+I)^{T-t}\ PA_0 < L_0 .$$

The benefit of choosing a higher level of I is to increase the distance from the bound on PR.

The last hypothesis for I relates the management's choice of I to the returns on the pension plan. Of the two interest rates, I and R, only I is audited. The auditor will bound the choice of I to reflect evidence like the contemporary market return on pension assets. The final hypothesis for I can be stated as

I-H2: The level of I chosen is directly related to RP.

Table 3.1

HYPOTHESES

$$R = \underset{}{\alpha_0} + \underset{(+)}{\alpha_1}\ CAPEXP + \underset{(-)}{\alpha_2}\ LIQ + \underset{(+)}{\alpha_3}\ PR \qquad A1$$

$$I = \underset{}{\beta_0} + \underset{(+)}{\beta_1}\ PR + \underset{(+)}{\beta_2}\ r_p \qquad A2$$

R-H1a: $\alpha_1 > 0$	I-H1a: $\beta_1 > 0$
R-H1o: $\alpha_1 \leq 0$	I-H1o: $\beta_1 \leq 0$
R-H2a: $\alpha_2 < 0$	I-H2a: $\beta_2 > 0$
R-H2o: $\alpha_2 \geq 0$	I-H2o: $\beta_2 \leq 0$
R-H3a: $\alpha_3 > 0$	
R-H3o: $\alpha_3 \leq 0$	

NOTE:

CAPEXP is the need to retain capital inside the firm for purposes of expansion of corporate assets.
LIQ is the liquidity position of the firm,
LIQ = A - K
PR is the ratio of the accumulated benefits to the pension assets.
$= B_T(1+I)^{t-t} PA_t$
r_p is the contemporary return on the pension assets.

CHAPTER IV
METHODOLOGY, SAMPLE SELECTION, AND DEFINITIONS

This chapter identifies the statistical procedures used to test the hypotheses generated in Chapter III. Since multiple tests are used, the linkages between tests will be discussed. The selection of the sample, operational definitions, and statistical characteristics of the sample are presented.

4.1 Methodology

Using the relations of the Comprehensive Problem in Chapter III, two behavioral statements can be made. These statements and the hypothesized directions of the coefficients were summarized in Table 3.1.

This section identifies the methodologies used in estimating equations A1 and A2. The equations estimated can be cataloged by the type of dependent variable and the measurement scale used. The dependent variables are either the levels of interest rate, or the change in interest rate. The change in interest rates can be measured as the original continuous levels or as a dichotomy.

The summarized model states that the manager's decision process for choosing the level of R, represented by equation A1 of equation set (A), involves determining (1) where assets can earn the highest return, CAPEXP, (2) the desired level of liquidity, LIQ, and (3) the level of risk sharing to be imposed on labor. Equation A2 describes the manager's decision process for choosing the level of I. The manager's choice of I involves the determination of (1) the level of risk to labor

disclosed by management, PR, and (2) the actual returns to the pension assets, r_p.

Prior research has used a simple cross-sectional LS estimation (Feldstein and Morck, 1983) to explain interest rate choices. Estimation of the equations separately by LS is therefore most closely related to prior research. A simple improvement in prior research, without abandoning the LS approach, is to reduce the noise in the dependent variable by making it clearly I or clearly R rather than some unknown combination. With less noise in the dependent variable, previous tests might now be of sufficient power to establish the relations. Thus, a simple cross-sectional (separate) estimate of the equations links this study with prior research.

In particular, before the test is performed, it is unknown whether an interest rate (whether I or R) is adjusted frequently or infrequently. If the speed of adjustment is fast, then only "optimal" levels of interest rates will be observed for a given level of independent variable. In addition, for any change in level of independent variable, an "optimal" change in interest rate will be observed.

However, a cross-sectional test of the levels of interest rates may not pick up all effects of independent variables. Hence, if firms take excursions away from the optimal choice then cross-sectional tests will show merely a large dispersion of interest rates for each level of independent variable. However, the chances of an adjustment in choice will be greater for those firms who have taken such an excursion than for those firms who have not. Therefore, the changes in interest rates from one year to the next will be used as dependent variables in a second estimation of (A).

Firms may take excursions away from the "optimal" level of interest rate when the cost of adjustment is high so that changes of interest rates are infrequent. In effect, the independent variable may have a threshold to cross before the interest rate will be altered. Thus, while there is wide dispersion of interest rates for any given level of independent variable, for extreme levels of independent variables, the frequency of changes in interest rates is higher.

It is also possible, despite the improved control introduced by separating I and R and using the change in interest rates, that linear techniques may not identify the relations. The dependent variables have lumpy distributions since managers tend to choose discount rates in one half percentage point numbers (e.g. 6% or 6.5%). This lumpy distribution may prevent LS estimates from capturing the relation. A technique for dealing with such distributions is to use a class variable for the change in interest rate (in place of the simple change in interest rate).

The classification variable for change identifies firms as either (1) not changing I (R) from one year to the next, or, (2) increasing I (R) from one year to the next. Again, the lumpy form of the distribution may obscure the true relation between I (R) and certain independent variables which the creation of a dichotomous variable can discover. For example, the debt to assets ratio is capable of considerable variation between zero and one. Where debt to assets moves around somewhat (but not yet enough to cause a change in I or R past the threshold of one half of a percentage point) then error terms are generated. These error terms may build sufficiently to prevent the identification of the true relation. A dichotomous treatment of changes in I or R that

identifies only the gross movements may improve the ability of the linear model to capture the relations. The loss due to a dichotomous treatment is, of course, that the finer variations of which the dependent variable was capable, are no longer included. Whether the gains outweigh the loss is an empirical question.

A suitable technique, when the dependent variable is dichotomous, is logit analysis. The application of logit analysis uses a log transformation of the dependent variable. Independent variables are fit to the transformed dependent variable in a (say) linear function by weighted least squares. Once the linear function is estimated, predictions in terms of the original units require the inverse of the transformation.

4.2 The Sample

The initial sample of firms was taken from the tape of pension information compiled by Vasarhelyi, Yang, and Faillace (1983). They surveyed 1288 companies that reported the FASB Statement 36 pension data for 1981 in footnotes to company annual reports. The financial statement footnote pension data was coded onto a machine readable tape. That sample was the basis for this study. That tape, FASB Statement 36 Data Bank (Version II), is the source of the footnote information including levels of I, accumulated benefits, and net pension assets for 1980 and 1981.

For the firms on Version II a screening of the Compustat tape was performed to identify companies for which other attributes would be available. There were 774 companies identified as common between the two tapes. A search was then conducted for Department of Labor information for those 774 companies.

The first effort was directed towards retrieving the data directly from the Department of Labor. The resulting sample of DOL information was fragmented for each company. It was not clear that all plans for the relevant sponsor had been collected, and it was felt that plans of subsidiaries would be difficult to identify. This data was therefore set aside and an alternative search for DOL data was resumed.

The Blue Book of Pension Funds (BBPF) is published by ERISA Benefits, Inc. and provided the solution to the problem of finding the DOL data. Two editions, 1982 and 1983, were consulted for information about the funding rate, R, and the returns to the pension trust, r_p. Each of the consulted editions contains, for each company, a list of pension plans directly sponsored by that company. The list in BBPF includes both defined benefit plans and defined contribution plans. Only defined benefit plans are relevant here. Subsidiaries are still not included and the data is limited in that respect. Sufficient detail is given, however, about the directly sponsored plans including certain actuarial assumptions and pension assets allocated to that plan.

An attempt was made to match by name in the BBPF the 774 companies from Compustat. Evidently, due to lags in reporting and availability there are a substantial number of companies for which complete data for 1979 and 1980 was not available. The problem is naturally more severe when newer data is required. Thus, while 617 companies had data for the year 1979, only 486 had newer data for the year 1980. In addition, while the BBPF is available on tape, the cost is $6,000, and hence the tape was not available. Therefore, the data from the BBPF was transferred by hand from the books to a machine readable form.

The procedure for transferring the BBPF data involved putting the data from the books onto a coding sheet by the author and two paid assistants. The hand coded sheets were sampled for errors. The data was then input by the author to a computer file. A sample of observations in the computer file were compared to the coded sheets for errors. The file was then subjected to reasonableness checks. Any remaining errors should be random.

4.3 Operational Definitions

Specific operational definitions are required in order to test the hypotheses. Naturally, operations definitions can only be imperfect surrogates of the theoretical constructs. To obviate these limitations multiple operational definitions were used for some of the theoretical constructs. Table 4.1 summarizes the distributions for the dependent variables, while Table 4.2 summarizes the distributions for the independent variables (see the next section for variable definitions).

4.3.1. Dependent variables

I(YR) (YR=80,81). This variable is the interest rate used for discounting pension benefits for presentation on the footnotes to the financial statements. When a single figure is given, as when a firm says 'the benefits are discounted at X%,' then this figure is the assigned value for I. When a single average is given, as when a firm says 'the benefits are discounted at an average of X%,' then the single average is used. When a range of rates is given, as when a firm says 'benefits are discounted with a range of rates from X% to Y%,' then the midpoint of the range is used as I. The source of I80 and I81 is the FASB Statement 36 Data Bank (Version II).

Table 4.1 shows the summary statistics of the sample. The average interest rate has risen from 1980 to 1981. The average for the years 1980 and 1981 were 6.95% and 7.38% respectively. The range is also increasing. The upper interest rate has steadily climbed from 13% in 1980 to 14.5% in 1981. The lower rate has remained constant at 4%.

R(YR) (YR=79,80). The BBPF discloses information about the pension plans of companies when those pension plans meet certain size criteria. The editors of the BBPF have a policy of presenting the most recent information available about any pension plan they have identified for which the company is a sponsor.

In the 1982 BBPF edition, 1979 is the most recent year for almost all plans (occasionally however, some plans have 1978 as the most recent plan). The interest rate used by a company for funding purposes is generally the same for all plans. In that case, the funding rate, R, for 1979, is taken to be the single interest rate used across the plans. The interest rate may sometimes be different across plans. In that case, the interest rate is taken to be the average of the interest rates used across plans weighted by the amount of assets in the plan. Using the midpoint of the interest rates across plans of a company produces similar results.

For the 1983 edition, 1980 is generally the most recent year. A very small number (23 companies) have (at least partial) 1981 data as the most recent year. The 1981 data is omitted from the sample. A significant number have the 1979 report still as the most recent year. That is, for some companies, there is no new data for 1980. What is more, for some companies, the 1980 data is available for some plans but not for all plans. The measurement of R for 1980 involved aggregating

the rate for plans for which 1980 data is available. Thus, for 1980 plans, the funding rate is the single interest rate across 1980 reports if there is only one rate or the weighted average of the interest rates on the 1980 reports if there is more than one rate.

From Table 4.1, the funding rate for 1979 was an average of 6.00%. The range is from 4% to 8.5%. The 1980 funding rate had an average of 6.32% with a range from 4% to 9.5%.

DELR. The change in the funding rate, DELR, from 1979 to 1980 is defined as R for 1980 less R for 1979. DELR between 1979 and 1980 is available for 411 companies. The average rate change is .31 percentage points. That is, a firm with an average change in R would change from (say) 7.00% to 7.31%. The low end of the range is generated by a firm who lowered the interest rate in 1980 compared to 1979 by two percentage points. The high end of the range is generated by firms who raised their 1980 funding rate by three and a half percentage points from their 1979 funding rate.

CHANGR. The change in funding rate, DELR, from 1979 to 1980 can also be coded as a dichotomous variable (i.e., firms that change and those that do not). Three firms lowered the interest rate R from 1979 to 1980. As a result of this small sample of firms who lowered R, the three firms are included with the set of firms who did not change R. If DELR is greater than .45 then the firm has changed (increased) interest rates. The hurdle is set higher than zero in order to capture as changers those firms for whom the effect will be most significant. For the sample of 411 firms for whom DELR is available, 108 companies increased R enough to be coded as having an interest rate increase.

DELI. The change in I from 1980 to 1981 is the footnote rate for 1981 less the footnote rate for 1980. The change in I from 1980 to 1981 was available for 798 companies. The change averaged .48 percentage points. The range was from a decrease of 3 percentage points to an increase of 6.45 percentage points.

CHANGI. When the change in the footnote rate from 1980 to 1981 is simply dichotomized, it is denoted CHANGI. The hurdle rate to be recorded as an increase is .45. The sample for which DELI was available amounted to 798 companies. Of this sample 500 did not increase the footnote rate while 298 companies did increase.

4.3.2 Independent Variables

CAPEXP(YR) (YR=79,80). One possible measure of whether a company has desirable opportunities for expansion is whether the company in fact makes expansions, or specifically, the level of capital expansion made. A figure for capital expansion is given in form 10-K (while the Compustat tape has this figure for a subset of firms). The level of capital expansion is divided by the book value of assets on hand at the beginning of the year. The amount of capital expansion in 1979 for this set of firms averaged 11% of the beginning book value of assets in 1979. The range was quite large, from 0% to 61% of the beginning book value of assets.

There are alternatives to this way of measuring relative opportunities. For example, the accounting rate of return, either by itself or compared to the return on the pension assets (r_p), can be used for a measure of relative opportunities. The accounting rate of return reflects primarily assets in place and thus may be a poor measure of new

opportunities. This measure was actually used but did not improve the explanation of R.

Another possibility is that the residual from a market model may capture the size and direction of new opportunities in which the firm ought to invest. This variable was also used but again did not affect the results presented here.

LIQ. Two measures of short term liquidity are used. The measures are SORS(YR) and CASHCL(YR) where YR = 78, 79, 80. The measures are constructed so that a smaller number will indicate a lower liquidity position. The objective of this measure is to capture the extent of cash availability.

The first measure, SORS(YR), scales cash inflow from all sources by the book value of assets at the end of the year. The cash inflow is found by identifying the total sources of funds from the Statement of Changes in Financial Position. If funds were measured as working capital then the net increase (decrease) in working capital (other than cash) was subtracted (added) from the sources of funds. Other things being equal, less cash inflows means more difficulty meeting debt obligations. In 1978, the average for SORS78 was .20, with a range of .82. In 1979 the average for SORS79 was .21, with a range of 1.12.

The second measure of liquidity is CASHCL(YR). This measure is the level of cash (including marketable securities) at the end of the year over the current liabilities at the end of the year. Decreasing levels of cash compared to current liabilities raises the probability that current bills will not be met. CASHCL78 averaged .34 and the least liquid firm had a ratio of .001 while the most liquid firm had a ratio of 2.62. CASHCL79 averaged .28.

Measures other than SORS or CASHCL are possible in trying to measure liquidity. One measure is the level of inventory plus accounts receivable compared to sales. Such a measure may capture the extent of stockpiling of inventory plus the investment burden of receivables. While this measure behaved suitably, it is conceptually inferior to a direct measure of burden such as CASHCL or SORS.

A second alternative is the debt to assets or debt to equity ratio of a company. This measure was used but did not perform any better on the current sample. It was therefore discarded.

A third measure of liquidity is cash compared to total current assets. This measure also captures the extent to which Accounts Receivable and Inventory are a burden to a company. This measure did at least as well as CASHCL but is interpreted in a less straightforward fashion. Therefore, only the results for CASHCL and SORS are reported.

AB(YR) (YR=79,80,81). The size of the reported accumulated pension benefits is denoted AB(YR). This information is in the footnotes to financial statements and is retrieved from Version II. The variable AB is recorded in millions of dollars. The average accumulated pension benefits in 1979 (1980, 1981) is $228,440,000 ($203,980,000, $248,320,000). The minimum for 1979 is $20,000. The largest accumulated pension benefits reported in 1979 from this sample is $18,156,500,000.

The average accumulated pension benefits decreased from 1979 to 1980 and then increased from 1980 to 1981. Two important features of AB are not held constant from year to year, however. First, the companies included in the sample vary from year to year. There are 532 companies in the 1979 sample compared to 1133 (858) companies in 1980 (1981).

Second, the interest rate for the companies in the sample did not remain constant from year to year. Since the accumulated pension benefits is a present value figure, it is sensitive to interest rate assumptions. The dissertation includes tests of certain hypotheses about the changes in interest rates and so the interest rates will be adjusted for in the next measure.

AAB(YR). The size of the reported accumulated pension benefits is a present value figure that already incorporates the dependent variable I. An adjustment will attempt to back out the differential effect of the dependent variable I. The adjusted accumulated benefits is denoted AAB.

The accumulated pension benefits as reported by the manager is not the variable considered by the manager when choosing a discount rate. Rather, when choosing the discount rate the manager takes account of the size of the other variables: the benefits, time to maturity, and some desired final size of the reported pension liability. The manager then selects an I that will transform the benefits and time to maturity into the desired final size of pension liability. The inputs are not available directly. From the actuarial identity, were everything known, it would be possible to identify the size of the pension liability before the footnote interest rate is chosen. That is, from the actuarial identity, the effect of management discretion over I could be backed out. Unfortunately, the inputs are not publicly known. However, a particular strategy will (partially) capture the effect of this relation. The proposed transformation is:

AAB = AB (I/AVERAGE VALUE OF I)

This transformation is based on a rule of thumb common in actuarial texts. The rule provides a linear approximation to the true change in present value that would result by changing the interest rate. Bulow (1981), Feldstein and Seligman (1981), and Bodie, Light, Morck, and Taggart (1984) similarly used a linear approximation to make discounted benefits somewhat more comparable.

Certain properties of the rule (and associated problems) can be easily demonstrated. It is possible for the rule to create a relation where none existed. The rule may alternatively obscure a relation that did, in fact, exist. Cases a and b are shown in Figure 4.1.

Case a represents the situation where management does not operate as hypothesized and the linear adjustment has too steep a slope. Case a describes a pair of managements that act contrary to hypothesis. The hypothesis states that the company with the greater benefits, all things equal, will choose the greater interest rate. The curve B'_T is a level of benefits in excess of the benefits B_T. At any common interest rate for discounting, B'_T maps to a present value figure greater than B_T. For the managements choosing rates 'x' and 'y' respectively, the relative present values observed after linear standardizing support the hypothesis though the managements are, in fact, not supportive of the hypothesis. If the rule is too steep, a relation can be induced that does not reflect the firm's activities.

Case b represents the situation where management does operate as hypothesized and the linear adjustment has too shallow a slope. Again, B'_T is greater than B_T. The firms in case b are, in fact, choosing higher interest rates as the benefits are higher. The relative present values after linear standardizing, however, show a contrary result.

Despite the Type I and Type II errors possible by the transformation, the present value of accumulated benefits can be adjusted to a standardized interest rate using the linear rule. Sensitivity of the coefficient to the rule was performed and the results do not differ substantially.

The average for AAB79 was $253,760,000. The average for AAB79 is not the same as for AB79. That is, the average after adjustment is not the same as the average before adjustment. This result was consistent with the suggestion that firms systematically choose pairs of accumulated pension benefits and interest rates. As a result, an average of the terms AB, with the weighting factor (I/AVERAGE OF I) will not produce the same average as the equally weighted terms AB.

Like the relation between AB79 and AB80, the average for AAB80 is lower than the average of AAB79. This result is due in part to the change in number of observations which went from 501 in 1979 to 1123 in 1980.

PA(YR) (YR=79,80,81). The pension assets available for benefits is disclosed in the footnotes to financial statements and therefore is retrieved from Version II. Identical to AB and AAB, the variable PA is recorded in millions of dollars. The average amount of pension assets reported by the sample companies was $219,040,000 in 1979. The average level of pension assets in 1980 (1981) was $221,140,000 ($288,070,000).

PR(YR) (YR=79,80,81). The ratio of (standardized) accumulated benefits, AAB, to the pension assets, PA, is the pension ratio, PR. An increase in this ratio indicates a deterioration in funding.

The average PR for 1979 is 1.06. That is, the (standardized) accumulated benefits were 6% greater than the pension assets in 1979 for

the average company. The average PR in 1980 (1981) was .96 (.83). This decrease in PR should not be interpreted as improved funding over the years since the numerator, AAB, is standardized to different interest rates each year.

RP. The earnings for the pension plan assets is taken from the 1983 volume of the BBPF. When the data for 1980 is available for a plan, the earnings of the plan for 1980 is scaled by the beginning assets of the plan. The return on the plan assets is the average returns across plans, weighted by the amount of beginning assets in the plan. The average return in 1980 was 14% with a range from a loss of 1% to a gain of 57%.

Table 4.1

SUMMARY OF DEPENDENT VARIABLES

Variable	N	Mean	Std. Dev.	Minimum	Maximum
I80	1126	6.95	1.11	4.00	13.00
I81	857	7.38	1.24	4.00	14.50
R79	617	6.00	.77	4.00	8.50
R80	486	6.32	.90	4.00	9.50
DELI	798	.48	.87	-3.00	6.45
DELR	411	.31	.67	-2.00	3.50

Table 4.2

SUMMARY OF INDEPENDENT VARIABLES

Variable	N	Mean	Std. Dev.	Minimum	Maximum
CAPEXP79	645	.11	.07	0	.61
CAPEXP80	645	.11	.07	0	.46
SORS78	530	.20	.10	.04	.86
SORS79	532	.21	.11	- .05	1.07
SORS80	533	.20	.11	.02	.81
CASHCL78	525	.34	.36	.001	2.62
CASHCL79	526	.28	.32	.002	3.55
CASHCL80	526	.28	.33	.002	3.26
AB79	532	228.44	1123.83	.02	18156.50
AB80	1133	203.98	900.48	.03	18337.00
AB81	858	248.32	1059.74	.13	21163.00
AAB79	501	253.76	1251.53	.08	20173.89
AAB80	1123	216.14	1018.43	.03	21107.34
AAB81	852	268.27	1264.17	.00	24231.35
PA79	530	219.04	1013.21	.17	16390.00
PA80	1129	221.14	1030.34	.12	25897.00
PA81	857	288.07	1374.15	.19	33523.70
PR79	496	1.06	.58	.0006	8.13
PR80	1114	.96	.79	.04	16.31
PR81	848	.83	.32	.14	3.66
RP	486	.14	.07	- .01	.57

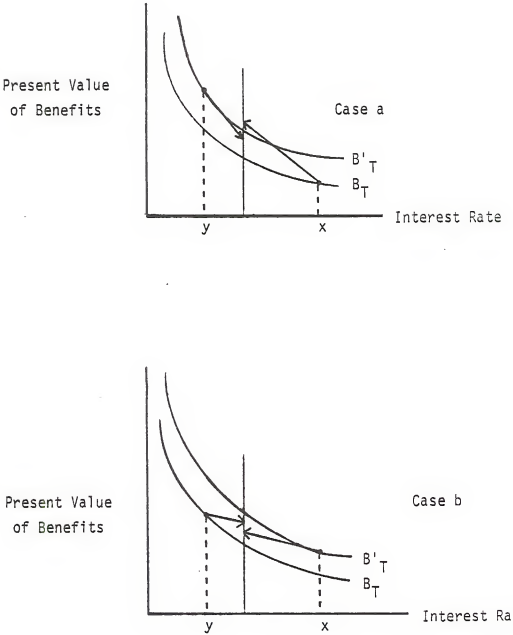
Present Value
of Benefits
Case a
B'T
BT
y
x
Interest Rate
Present Value
of Benefits
Case b
B'T
BT
y
x
Interest Rate

Figure 4.1

CHAPTER V
RESULTS

5.1 Introduction

The results are presented in four major sections. Section 5.2 describes the simple correlations between the variables. Section 5.3 presents the results pertaining to the determinants of DOL reporting. Section 5.4 discusses the findings related to SFAS 36 reporting.

Section 5.2 relates the simple correlations between variables. The correlations are presented (1) within the dependent variables, (2) between the dependent variables and independent variables, and (3) within the independent variables. Tables 5.1 and 5.2 summarize these results.

Section 5.3 presents the results of estimating the determinants of reporting to the DOL. Tests were conducted both on the simple level of reported DOL interest rate and on two variations of changes in the reported DOL interest rate. When a particular hypothesis is discussed, the results across each test that bear evidence on the hypothesis are used. Such a summary across tests will hopefully provide a better perspective of the influence of a particular independent variable on reporting choices.

Section 5.4 discusses the results of estimating the determinants of the reporting to the FASB. The hypotheses regarding the choice of the FASB interest rate were also tested using both the simple level of SFAS 36 interest rate and two variations of changes in SFAS 36 interest rate. For a particular hypothesis, the results of all relevant tests will be

discussed serially. As with the DOL interest rate, such a discussion will provide a broader perspective of the evidence regarding a particular hypothesized force. Finally, the results are recapitulated in the summary, Section 5.5.

5.2 Simple Correlations

The simple correlations are presented in two groups with each group related to a specific table. The first group of correlations relates the variety of dependent variables to themselves. Table 5.1 presents this set of results. The second set of relations is both (1) between the dependent and independent variables and (2) between the various independent variables. These correlations are laid out in Table 5.2.

As previously explained, there are two reported interest rates and the tests include both simple levels of interest rates, changes in interest rates, and the difference between interest rates. Table 5.1 presents the correlations between these various dependent variables.

An expected result in Table 5.1 is that reported interest rates are highly related to the same variable a year earlier. For example, the variable I81 is highly related to I80; R80 is highly related to R79. Even the magnitudes are similar (.72 and .68).

The two interest rates are also significantly related to each other for the same year. The year 1980 is the only year for which both interest rates are known. The correlation between I80 and R80 is .41 where 459 sponsors were included. This association, however, between the rates is much smaller than the association of either rate with its lagged value. There are two explanations. The first is that environmental forces have driven the rates apart per the hypotheses. The second is that the coded values of the interest rates are from different

data bases and systematic measurement biases in the data bases has driven the rates apart. That is, any bias is consistent within a data base (or coding) procedure but inconsistent between data bases. Naturally, the answer can be a combination of these.

There are also systematic negative relations between the level of interest rate and the change in interest rate. For both I and R, if the base year's interest rate is high (low) then there is less (more) propensity to change the interest rates. Therefore, with remarkable similarity (-.23 and -.25), the correlations between I80 and DELI and between R79 and DELR are negative. Likewise, if the ending year's interest rate is high (low) then the interest rate got there by increasing (not changing). In summary, there was a group of firms with high interest rates in the base year and a group of firms with low interest rates in the base year. The group with high rates does not change and a portion of the group with low rates in the base year raise their rates. This produces a positive correlation between base year interest rate and change in interest rate, and this also produces a negative correlation between end year rate and the change in rate.

Table 5.2 presents the correlations between dependent and independent variables. The two prominent characteristics of Table 5.2 are (1) the negative relation between I and the liquidity measures, SORS and CASHCL, and (2) the positive relation between I and PR. The first relation persists for both years' I and any SORS or CASHCL. The second relation persists at high levels of significance for all the combinations of I and PR, save one. The combination of I81 and PR79 is the least significant of these combinations and that combination is significant at the 10% level.

The positive relation between I and PR was according to expectations. The negative relation between I and the liquidity measures was not explicitly addressed in any hypothesis. One possible explanation is a strong correlation between PR and the liquidity measures so that a relation between I and PR induces a relation between I and liquidity. Looking ahead, Table 5.2 shows a high level of association between PR and SORS but Table 5.2 shows no significant association between PR and CASHCL until 1981. A second possible explanation is that I is a surrogate for the interest rate used for computing expense and SORS has net income as a large component. Large I is chosen for firms with net income below average, inducing the observed negative correlation. Likewise, from Table 5.2 the liquidity measures are closely related in a statistical sense and thus the negative correlation between I and CASHCL follows from the negative correlation between I and SORS.

The variable R does not exhibit the same strong relations that I exhibited in Table 5.2. The variable R is negatively related to the liquidity measures which is consistent with the hypothesis. The association is not as strong, however, as the relation between I and liquidity. Neither the coefficients nor the significance level is as strong as with I. The most significant relation between R and liquidity is between R79 and CASHCL78 which is significant at the 4.79% level.

The variable R is positively related to PR as hypothesized. The relation is more significant for R80 than for R79. When the combination is R80 and PR80 or PR81 the significance is quite high. Further, the correlation coefficient is higher between R80 and any PR than between R79 and PR. The association between R80 and PR possesses a significance level comparable to I. The associations between R80 and PR and between

I and PR are both generally significant at conventional levels. The coefficients relating R80 and PR are not consistently greater than the coefficients relating I and PR.

Finally, R79 is positively related to RP but R80 is not related to RP at conventional significance levels. The relation between RP and R79 is evidence in favor of the hypothesis that income recognition for the pension assets moves in (lagged) concert with actuarial assumptions.

The variables for the change in interest rates show distinctive characters. The variable DELI is unrelated to any independent variables at conventional levels of significance except for PR81. For all but CAPEXP and PR81 the correlation is small in magnitude and the sign is negative. The sign of the coefficient relating DELI and CAPEXP is positive. The magnitude of the coefficient relating DELI and PR81 is significant at the .0037 level. The variable DELR is related inversely to CASHCL and directly to PR. These signs are consistent with the hypothesized directions. The significance level for the relation between DELR and CASHCL78 is 19.42% and the significance level for the relation between DELR and CASHCL79 is 5.55%. The similar dimensions for PR79, PR80, and PR81 are 24.51%, .0001%, and .0029%, respectively.

Table 5.2 also describes the correlations within the independent variables and is useful for evaluating potential difficulties with multi-collinearities. For starters, notice that all variables are correlated with their lagged values. For example, CAPEXP80 is related to CAPEXP79. Next, notice that CAPEXP is highly related to the liquidity measures, except in one case. The scenario that explains this is that the liquidity measures must be good prior to and in concert with the expansion. The expansion uses up the excess liquidity and after the

expansion, the liquidity measure is unrelated. Consistent with this, CAPEXP80 is related to (1) CASHCL78, (2) CASHCL79, and (3) SORS. However, CAPEXP79 is not significantly related to CASHCL79, nor is CAPEXP80 significantly related to CASHCL80. As a result, multicollinearity is likely to be present in estimating the determinants of R.

Next, note that the liquidity measures are interrelated at a high level of significance. The numerator of the variable SORS is the level of cash inflows for the sponsor. The numerator of CASHCL is the stock of cash at the end of the year. If large cash inflows are not easily disposed of or if below average cash flows are not easily remedied then the stock of cash at the end of the year will follow closely the cash inflow of the year. While the observed associations show a correct sign and are very significant, the correlation coefficients are not of a large magnitude.

As a final note on the liquidity measures, the highest absolute value of a coefficient between any liquidity measure and RP or PR is that for SORS78 and any PR value. In contrast, the correlation between CASHCL and either RP or PR is not generally significant at conventional levels until the year 1981. Therefore, one liquidity variable, SORS, is related to PR79 and PR80, while another liquidity variable, CASHCL, is not related to PR79 and PR80. All liquidity variables are related to PR81.

The last variable to discuss is the variable RP. The variable RP has a small positive relation to PR79 that is not significant at any conventional level. The coefficient relating RP to PR turns negative for PR80 but still has a low significance level of 19.92%. Finally, the relation between RP and PR is both negative and significant for PR81.

The significant and negative relation is what would be expected. Increases in earning of pension assets in 1980 should be expected to raise the stock of pension assets used in the computation of PR in 1981. Such increases in the level of pension assets should lead to lower PR in subsequent years. Thus the significant negative correlation between RP and PR81 is evidence that the measurement error in RP does not take away all chance of finding the hypothesized patterns among variables.

5.3 Reporting per DOL

A statement of how the sample size shrunk is given in Table 5.3 while estimates of the determinants of the rate reported to the DOL are presented in Table 5.4. The two alternative dependent variable measures used are (1) the actual level of DOL interest rate and (2) changes in the DOL interest rate. The second variable, which uses the changes in the DOL interest rate, was measured either on a continuous scale or as a dichotomous variable. While LS regression is used to estimate relations in the case of continuous dependent variables, the dichotomous dependent variable relationships are estimated by logit analysis.

The sample size for the equations falls precipitously from the initial number of companies available on Version II. As shown in Table 5.3 the variable R79 (R80) was collected for 617 (486) companies. Of these companies, CAPEXP79 (80) was available from the Compustat tape for 476 (369) companies. Further, the data requirements to construct SORS78 cause another 91 companies to drop out, leaving 385 companies. That there is incomplete overlap between observations with CAPEXP available and observations with SORS available is also suggested in Table 5.2 where (of 645 companies that had CAPEXP79) only 531 companies had SORS79. Finally, the variable PR79 (80) caused 226 (10) companies to

drop out. The variable PR was a voluntary disclosure in 1979 but a requirement for 1980. Consequently, few companies reported the 1979 figure, while the 1980 figure was available for almost all companies.

The results are presented for each hypothesis in turn. That is, for each hypothesized force the evidence that each analysis generates about that force will be discussed. While some interpretation will be provided here, the main conclusions will be deferred to Chapter Six.

The first hypothesis relates expansion opportunities to the reporting to the DOL. The results are not strong support for the hypothesis. When the explained variable is the actual level of interest rate then the cross-sectional results for expansion opportunities are not significant at conventional levels. The t-statistics are small and the coefficients change signs from a minus in 1979 to a plus in 1980 for equation 5.4.3. The values of the coefficients are generally small in magnitude.

The coefficient of CAPEXP that comes closest to being significant (albeit the wrong sign) at conventional levels is CAPEXP80 in equation 5.4.4. However, as Table 5.2 reveals, the correlation coefficient between CAPEXP80 and SORS80 is .65 which induces concerns about multicollinearity in equation 5.4.4. As a result, the coefficients of CAPEXP are suspect in equations with the actual level of R as a dependent variable.

When the dependent variable is the change in DOL interest rate, DELR, then the significance level improves and the coefficient is in the direction consistent with the hypothesis (the magnitude of the t-value, however, is still somewhat small).

When the dependent variable measure is the dichotomous CHANGR, the logit-estimated coefficient is 3.58 and the significance level is 18%. This significance level, however, is not what is conventionally desired.

In summary, the coefficients for the first hypothesis were generally of the sign consistent with the hypothesis but were not significant at conventional levels. The coefficients estimated may be due to chance. If the coefficients were due to chance then companies do not save on the pension contribution in order to take on new corporate investments. On the other hand, if the coefficients are not due to chance, then equations 5.4.5 and 5.4.6 suggest that companies time an increase in DOL interest rates to coincide with an increase in expansion. Between the two potential conditions that (1) sponsors continuously adjust the DOL interest rate to the level of capital expenditure or (2) sponsors make infrequent adjustments, the evidence suggests that sponsors make infrequent adjustments which are timed to coincide with a capital expansion.

Additional operational definitions of new opportunities for investment for the company were used, though they are not reported here. Such measures included (1) a comparison of accounting rates of return with the return on pension assets (RP) and (2) excess returns from a market model of the sponsor's common stock. These measures also did not possess significant explanatory power.

The second hypothesis relates the rate reported to the DOL with measures of liquidity. The measures of liquidity used are the cash inflow compared to assets, SORS, and the stock of cash compared to current liabilities, CASHCL. The sign expected for the coefficient is negative. When the dependent variable is the actual level, R, the signs

of CASHCL78, SORS79, and CASHCL79 are negative and thus consistent with the hypothesis, though not significant. The only liquidity measure with a positive sign is SORS78, however, the multicollinearity problems with SORS have already been noted. The coefficients are more significant for CASHCL than for SORS. The magnitude of the coefficients for CASHCL state that for a difference of 50% in the stock of cash between two sponsors (if current liabilities are the same) the DOL interest rate chosen will be expected to be higher by about .1 (.20 x .5 for equation 5.4.3) for the firm with the smaller cash level. This magnitude of difference in the interest rate does not seemingly translate into a large cash savings by itself. Therefore, the magnitude is smaller than is likely to be generated if the alternative hypothesis is correct.

When the dependent variable is the change in interest rate (DELR), liquidity shows up well as an explanation of change. The results for the LS analysis do not suggest this as dramatically as the logit analysis. Prominent in the logit analysis is the coefficient for SORS79. The coefficient is of a large negative magnitude and has a level of significance of .03. For example, from equation 5.4.6, a firm whose cash flow was smaller than average (if assets are the same) would be significantly more likely to increase the actuarial rate. This order of magnitude in the coefficient produces the sort of response by management to environmental forces that are plausible, given the hypotheses.

The other coefficients estimated for the liquidity measures are of less significance. The LS analysis gave a coefficient of -.24 for CASHCL79 and gave a coefficient of -.56 for SORS79. Between the logit and LS analysis the ranking of significance of the liquidity variables

changed. In equation 5.4.5 CASHCL79 was more significant and in equation 5.4.6 SORS79 was more significant.

The hypothesis relating liquidity to the DOL interest rate choice suggests, as did the earlier hypothesis, that the DOL interest rate is infrequently adjusted. In effect, the DOL interest rate is left alone until the need for cash is severe. When the firm suffers a liquidity crunch the DOL interest rate is raised.

The final hypothesis for DOL reporting relates R with PR. The coefficients for PR80 are of the direction consistent with the hypothesis and are significant at a .01 level in all equations. The magnitudes of the coefficients, though at a level of significance supporting the alternative hypothesis, are smaller for PR79 than for SORS.

Overall, it can be stated that certain determinants of reporting to the DOL have been captured. The model explaining the actual level of R produced low values of R^2; the R^2 for 1979 was .02 and the R^2 for 1980 was .09. These values compare favorably with Bodie, Light, Morck and Taggart (1984) where the R^2 was found to be .02 and .05 across two models with 515 observations. The number of observations is this current dissertation's sample were less and the R^2 of the model higher than the Bodie, Light, Morck, and Taggart model. This study included 155 companies for 1979 and 296 companies for 1980. The R^2 for equations 5.4.1 through 5.4.6 were smaller, however, than the R^2 found by Feldstein and Morck (1983). The R^2 of Feldstein and Morck ranged up to .25 using actual levels of interest rates.

The analyses that modeled the change in interest rate produced an R^2 of .05 for the LS analysis and a D^2 of .16 for the logit analysis. The D^2 statistic is a descriptor of overall model fit for logit analysis

as R^2 is for LS. No study has previously provided measures of model fit where the dependent variable is the change in interest rate. Therefore, a comparative benchmark from the literature is not available.

5.4 Reporting per FASB

A statement of how the sample size is derived is given in Table 5.5, while estimates of the determinants of the rate reported per SFAS 36 requirements are presented in Table 5.6. Two alternative dependent variable measures used are (1) the actual level of SFAS 36 interest rate and (2) changes in the SFAS 36 interest rate. The second variable, which uses the changes in the SFAS 36 interest rate, was measured either on a continuous scale or as a dichotomous variable. While LS regression is used to estimate relations in the case of continuous dependent variables, the dichotomous dependent variable relationships are estimated by logit analysis.

The sample size available for estimating the determinants of I was 459 (439) in 1980 (1981). As shown in Table 5.5 the variable I80 (I81) was available for 1126 (857) companies. The data requirements for the return on pension assets, RP, reduced the sample to 459 (440). Of these companies, data for PR was available for all companies for 1980; one company falls out for 1981.

The results are presented for each hypothesized variable in turn. The evidence from all models that bears on each hypothesis is presented at one time. Some comments are made here about the results but the main interpretations are deferred to in Chapter Six.

The first hypothesis relates the level of I to PR. The coefficients, as expected, are positive and consistently so. The coefficients are .45 and 1.59 for PR in 1980 and 1981, respectively. The

coefficients estimate that for a $10 decrease in assets on an initial benefits to assets ratio of $100/$60, the FASB interest rate will be .15 (.53) percentage points higher if estimated in 1980 (1981). The t-statistics are significant at the .0001 level which leads to confidence in the magnitude of the coefficients.

The coefficients are plausible for PR, given the hypothesis. As mentioned, however, the results differ across years somewhat (.45 versus 1.59) which is surprising in view of the close match in sample size (459 versus 439). Section 4.2 noted that the range and standard deviation of I had broadened from 1980 to 1981. It is possible that the increase in range of the dependent variable in 1981 resulted in better estimators in 1981. It is also possible that, in view of 1981 being the second year of experience with SFAS 36, there was a (small) structural shift in reporting strategy.

When the dependent variable is the change in SFAS 36 interest rate from 1980 to 1981 there are two analyses to consider. The LS analysis between DELI and PR81 produced a coefficient of .36. The logit analysis produced a coefficient of .62. Both of the coefficients are significant at conventional levels. The coefficients suggest that firms with high levels of PR in 1981 made changes in I from 1980 to 1981. However, the t-statistic in equation 5.5.3 is lower than in equations 5.5.1 and 5.5.2 which suggests that not all firms with large PR81 engaged in this practice. Perhaps only a few firms engaged in this practice whereupon the explanatory power of this equation should be small (as indicated by the low R^2 levels).

The results for the independent variable PR are consistent with the hypothesis. The results suggest a tendency for firms with a larger

unfunded liability to choose higher rates. The R^2 on the model, while high compared to other models in this study, is low in an absolute sense.

The significance level of the coefficients for PR in Table 5.6 suggest a faster speed of adjustment for I than was true for R. The coefficients for PR were much more significant for equations 5.5.1 and 5.5.2 than for equations 5.5.3 and 5.5.4. Sponsors evidently tend to keep the discount rate I in some optimal relation to PR.

The other hypothesis regarding I relates the SFAS 36 interest rate to the return on the pension assets (RP). In the models explaining I80 and I81, the coefficients are of a sign consistent with the expected direction of the hypothesis. The t-statistics are 1.30 and 1.27 for 1980 and 1981, respectively, which is low. In the model explaining DELI the coefficient is again positive as hypothesized, but the t-statistic falls even further to .24. As with the first hypothesis regarding I, the coefficient and t-statistic are smaller for the model explaining DELI than for the models explaining I. The logit analysis produces a peculiar result in that the coefficient changes sign from the previous models. The chi-square statistic is low, however.

Overall, the models explaining I produced R^2 of .07 and .16 for 1980 and 1981, respectively. The sample size was 459 and 439 observations, respectively. This model fit is a substantial improvement over the R^2 for models explaining R. The models explaining DELI and CHANGI had worse model fit statistics than models explaining DELR and CHANGR. In particular, the comparison of model fit statistics is a pair of R^2 of .05 and .02 for the models explaining DELR and DELI, respectively. The same comparison of model fit for the logit analysis gives D^2 of .16 and

.04 for CHANGR and CHANGI, respectively. In summary, the model fit statistics for actual levels of interest rates were better for I than for R. The model fit statistics for changes in interest rates were better for R than for I. It has already been stated that the evidence suggests a faster speed of adjustment for I than for R.

5.5 Summary

In summary, LS models were estimated to establish the determinants of R, DELR, I, and DELI. Logit models were estimated to establish the determinants of CHANGR and CHANGI. When DOL reporting was investigated, changes were better modeled than levels. In particular, logit produced the highest score for model fit. When SFAS 36 reporting was investigated, the variables explained levels better than the variables explained changes. The highest R^2 was for I81 where R^2 was .16.

Table 5.1

CORRELATIONS WITHIN THE DEPENDENT VARIABLES

(Coefficient
Probability under the null
Number of observations)

	I80	I81	R79	R80	DELR	DELI
	1.0000	.7290	.2783	.4115	.2623	-.2315
I80	.0000	.0001	.0001	.0001	.0058	.0001
	1126	798	573	459	388	798
		1.0000	.1871	.2651	.2958	.4970
I81		.0000	.0001	.0001	.0001	.0001
		857	543	440	368	798
			1.0000	.6838	-.2566	-.1059
R79			.0000	.0001	.0001	.015
			617	411	411	526
				1.0000	.5297	-.1365
R80				.0000	.0001	.0046
				486	411	429
					1.0000	-.0437
DELR					.0000	.4932
					252	368
						1.0000
DELI						.0000
						798

Table 5.2

CORRELATIONS BETWEEN DEPENDENT AND INDEPENDENT VARIABLES

{ Coefficient
Probability under the null
Number of Observations }

	CAPEXP79	CAPEXP80	SORS78	SORS79	SORS80	CASHCL78	CASHCL79	CASHCL80	PR79	PR80	PR81	RP
I80	-0.07897 0.0546 593	-0.06377 0.1205 594	-0.16590 0.0003 484	-0.14833 0.0010 486	-0.09880 0.0276 487	-0.10474 0.0216 481	-0.11376 0.0124 482	-0.09171 0.0442 482	0.15247 0.0007 489	0.16585 0.0001 1114	0.32053 0.0001 793	0.04409 0.3460 459
I81	-0.05970 0.1796 593	-0.08405 0.1189 594	-0.16812 0.0002 479	-0.11738 0.0052 481	-0.12704 0.0053 482	-0.14246 0.0018 477	-0.13132 0.0040 478	-0.11939 0.0090 478	0.06623 0.1005 364	0.10902 0.0021 796	0.36010 0.0001 848	0.01319 0.7826 440
R79	-0.03644 0.4276 476	0.02073 0.6819 476	-0.05179 0.3101 386	-0.06924 0.1746 386	0.03466 0.4971 386	-0.10114 0.0479 383	-0.09702 0.0592 382	-0.05470 0.2869 381	0.05868 0.3404 266	0.04885 0.2436 571	0.17478 0.0001 542	0.07781 0.1152 411
R80	-0.08383 0.1079 369	-0.02574 0.6222 369	-0.02106 0.7124 309	-0.07547 0.1858 309	0.02185 0.7020 309	-0.08786 0.1239 308	-0.09174 0.1086 307	-0.06861 0.2307 307	0.11150 0.0990 220	0.21229 0.0001 459	0.23600 0.0001 429	0.05034 0.2681 486
DELI	0.04093 0.3266 576	0.01303 0.7549 577	-0.02308 0.6184 468	-0.08564 0.0286 470	-0.04364 0.3446 471	-0.03775 0.4163 466	-0.01139 0.8060 467	-0.03676 0.4281 467	-0.02270 0.6681 359	-0.04841 0.1724 796	0.10283 0.0037 793	-0.00238 0.9608 429
DELR	-0.04586 0.4056 331	-0.00663 0.9043 331	-0.03913 0.5180 274	-0.07069 0.2435 274	-0.02517 0.6783 274	-0.07882 0.1842 273	-0.11623 0.0555 272	-0.12617 0.0346 272	0.08564 0.2451 186	0.21081 0.0001 388	0.15281 0.0029 378	0.01021 0.8366 411
CAPEXP79	1.00000 0.0000 645	0.83110 0.0001 644	0.40930 0.0001 529	0.57811 0.0001 531	0.44251 0.0001 531	0.13488 0.0020 524	0.02934 0.5023 525	-0.02334 0.5940 524	-0.00129 0.9836 259	-0.05468 0.1840 592	-0.06775 0.0328 592	-0.01026 0.8443 369
CAPEXP80		1.00000 0.0000 646	0.44008 0.0001 529	0.43289 0.0001 531	0.65510 0.0001 532	0.11332 0.0094 524	0.09812 0.0245 525	-0.02865 0.5124 525	-0.05325 0.3925 260	-0.04398 0.2850 593	-0.12352 0.0026 593	0.02950 0.5722 369
SORS78			1.00000 0.0000 530	0.71292 0.0001 530	0.52591 0.0001 530	0.08351 0.0558 525	0.15386 0.0004 524	0.10547 0.0158 523	-0.16319 0.0197 204	-0.09347 0.0400 483	-0.19617 0.0001 479	-0.02289 0.6873 309
SORS79				1.00000 0.0000 532	0.63756 0.0001 532	0.07123 0.1031 525	0.18467 0.0001 526	0.12828 0.0032 525	-0.11873 0.0864 204	-0.07560 0.0838 485	-0.17205 0.0001 481	-0.06818 0.2231 309
SORS80					1.00000 0.0000 533	0.09170 0.0357 525	0.11061 0.0111 526	0.12484 0.0041 526	-0.18748 0.0072 204	-0.06718 0.1392 486	-0.17396 0.0001 482	0.04299 0.4515 309
CASHCL78						1.00000 0.0000 525	0.72377 0.0001 524	0.63514 0.0001 523	0.04193 0.5525 203	-0.07123 0.1191 481	-0.10761 0.0187 477	0.04615 0.4196 308
CASHCL79							1.00000 0.0000 526	0.85276 0.0001 525	-0.00434 0.9911 202	-0.01770 0.6985 481	-0.09744 0.0332 478	0.05182 0.3656 307
CASHCL80								1.00000 0.0000 526	-0.03268 0.6342 202	0.00509 0.8941 481	-0.08399 0.0669 478	0.02034 0.7226 307
PR79									1.00000 0.0000 496	0.56115 0.0001 488	0.42666 0.0001 359	0.03605 0.5946 220
PR80										1.00000 0.0000 1114	0.53173 0.0001 791	-0.06003 0.1992 459
PR81											1.00000 0.0000 848	-0.10103 0.0343 439
RP												1.00000 0.0000 486

Table 5.3

DISPOSITION OF THE SAMPLE RELATED TO R

	Number of Observations Missing	Remaining
Total of Version II		1288
R79	671	617
CAPEXP79	141	476
SORS78	91	385
CASHCL78	3	382
PR79	226	156
Total of Version II		1288
R80	802	486
CAPEXP80	117	369
SORS79	61	308
CASHCL79	2	306
PR80	10	296

Table 5.4

REPORTING PER DOL

5.4.1	R79 = 6.06	− .21 CAPEXP79	+ .13 SORS78	− .22 CASHCL78	+ .10 PR79		n = 156	
(t-statistics)		− .25	.17	−1.11	.71			
(α level)		.80	85	.26	.47		R^2= .01	
5.4.2	R79 = 6.03	− .93 CAPEXP79	+ .80 SORS79	− .31 CASHCL79	+ .10 PR79		n = 155	
(t-statistics)		− .87	.90	−1.46	.79			
(α level)		.38	.37	.14	.43		R^2= .02	
5.4.3	R80 = 5.74	+ .53 CAPEXP80	− .12 SORS79	− .20 CASHCL79	+ .63 PR80		n = 296	
(t-statistics)		.62	− .20	−1.23	4.90			
(α level)		.53	.84	.22	.0001		R^2= .09	
5.4.4	R80 = 5.58	− 1.21 CAPEXP80	+ 1.47 SORS80	− .23 CASHCL80	+ .66 PR80		n = 296	
(t-statistics)		−1.12	1.94	−1.45	5.19			
(α level)		.26	.05	.14	.0001		R^2= .09	
5.4.5	DELR = .12	+ 1.09 CAPEXP80	− .56 SORS79	− .24 CASHCL79	+ .27 PR80		n = 262	
(t-statistics)		1.56	−1.12	−1.67	2.65			
(α level)		.12	.26	.09	.01		R^2= .05	
5.4.6	$\ln\left(\frac{\text{CHANGR}}{1-\text{CHANGR}}\right)$ = −1.13	+ 3.58 CAPEXP80	− 4.49 SORS79	− .73 CASHCL79	+ .84 PR80		n = 262	
(chi-square)		1.78	4.41	1.38	5.58			
(std error)		2.68	2.14	.63	.35		D^2= .16	
(probability under the null)		.18	.03	.24	.01			

Table 5.5

DISPOSITION OF THE SAMPLE RELATED TO I

	Number of Observations	
	Missing	Remaining
Total of Version II		1288
I80	162	1126
RP	667	459
PR80	0	459
Total of Version II		1288
I81	431	857
RP	417	440
PR81	1	439

Table 5.6

REPORTING PER FASB

5.5.1	I80	= 6.36 + .45 PR80 +	.94 RP	n_2	= 459
(t-statistic)		5.55	1.30	R^2	= .07
(α level)		.0001	.19		
5.5.2	I81	= 5.89 + 1.59 PR81 +	1.00 RP	n_2	= 439
(t-statistic)		9.09	1.27	R^2	= .16
(α level)		.0001	.20		
5.5.3	DELI	= .13 + .36 PR81 +	.14 RP	n_2	= 429
(t-statistic)		2.74	.24	R^2	= .02
(α level)		.01	.81		
5.5.4	$\ln\left(\frac{CHANGI}{1-CHANGI}\right)$	= -.70 + .62 PR81 -	2.06 RP	n	= 429
(chi-square)		4.04	2.06	D^2	= .07
(std error)		.31	1.43		
(α level)		.04	.15		

CHAPTER VI
SUMMARY AND CONCLUSIONS

6.1 Summary

This dissertation examined possible determinants of interest rate expectations reported (1) to the Department of Labor (DOL) and (2) as part of the financial statements per SFAS No. 36. The interest rates reported in these two reports are not required to be the same. Being "expectations," the rates are difficult to verify at the time of the reports and consequently managers alter the "expectations" to suit their own incentives and those of the consumers of the reports.

Examination of the determinants of reported expectations has value to several groups. Academicians value such an examination because of their intrinsic interest in how reporting choices are made. Policy makers also have an interest in how reporting choices are made. The policy maker's interest in the research is as an input to potential changes in regulations. Depending on the goals of the policy maker and the tools at their disposal, the policy maker may conclude either that the current regulation is adequate or that the regulation should be altered. Finally, managers without prior knowledge of such reporting choices have an interest in the acquisition of information on accounting choices.

A model of the manager's reporting problem was developed. The solution to the manager's problem required that the manager select (1) an interest rate for funding purposes and reporting to the DOL and (2)

an interest rate for disclosure purposes only per SFAS No. 36. Based on the model, testable hypotheses were derived about the relation between each reporting choice and firm specific variables. The hypotheses and the results pertaining to the DOL interest rates are discussed first, followed by a similar discussion of SFAS No. 36 reporting.

The reporting to the DOL was assumed to be motivated by cash flow considerations. Consequently, when a company is in need of cash inside the corporation, a higher value will be chosen for the DOL interest rate reported. One reason for needing cash is to expand physical assets, while a second reason is that the store of liquidity is low. These two instances of cash needs were explicitly investigated as hypotheses. Another consideration in selecting a DOL interest rate is the sharing of the risk burden between labor and other claimants to the firm (debt holders and equity holders). High levels of unfunded liability will imply that a high DOL interest rate is used.

The tests of these variables as determinants of DOL interest rate choice were conducted as follows. The extent to which the variables explained (1) the actual level of DOL interest rate and (2) the year-to-year change in DOL interest rate was examined. Tests on both the actual level and change in level of DOL interest rate are desirable because the frequency with which management adjusts the DOL interest rates is not observable. If the frequency of adjustment is high, then in a cross-sectional test only optimal levels of DOL interest rate will be observed for given levels of independent variables. However, if the frequency of adjustment is low, so that changes in DOL interest rate are made only infrequently, then for a cross-sectional test the observed level of DOL interest rate can range widely for given levels of independent

variables. In this latter case, a cross-sectional test may introduce excessive noise, and hence a year-to-year change test becomes more appropriate. As a result, for a set of independent variables, both the level as well as the change in level of DOL interest rate is used as the dependent variable.

Results for the individual independent variables explaining the DOL rate are discussed in turn. The results provided only weak support for the hypothesis that either the actual level of DOL interest rate or the change in DOL interest rate is directly related to the level of capital expansion. The signs of the coefficients for the capital expansion variable were generally negative for the equations when the dependent variable was the actual level. In the case of the change in DOL interest rate, the signs were positive, though the coefficients were not significant at conventionally desired levels.

For the actual level of DOL interest rate, the hypothesis that liquidity would have an inverse relation was not supported at a conventionally significant level. The sign was negative, as hypothesized, but the significance was low. In contrast, when the dependent variable was the change in interest rate, the coefficient for the liquidity variable was negative (as expected) and significant. As a result, liquidity appears to explain changes in DOL interest rates but does not explain the actual level of DOL interest rate.

The final hypothesis for the DOL rate states that the pension ratio (the ratio of the present value of accumulated benefits to net pension assets) is directly related to both the actual level of DOL interest rate and the change in DOL interest rates. The results suggest that for

1980, the pension ratio is a significant variable in explaining both the actual level of DOL interest rate and changes in the DOL interest rates.

The rate reported per SFAS No. 36 is hypothesized to be positively correlated with both the level of the pension ratio as well as the contemporary return on pension assets. As with the DOL interest rates, two dependent variables were used: the actual level of SFAS No. 36 interest rate and the change in the SFAS No. 36 interest rate. The results suggest that both the actual level of SFAS No. 36 interest rate and the change in SFAS No. 36 interest rate depend directly on the pension ratio. The coefficient is always positive and significant at conventional levels.

The results of the tests provide little support for the hypothesis that the actual level of SFAS No. 36 interest rate (or the change in SFAS No. 36 interest rate) depends on the contemporary return on pension assets. When the dependent variable is the level of the rate, the coefficients are positive but the significance is low. When the dependent variable is the change in interest rate, the coefficient is unstable and changes sign depending on whether the change is analyzed at a dichotomous or continuous level. In any case, the significance is low.

At an overall level, the model fit statistics were low. For the model of DOL reporting, using the change in DOL interest rate as a dependent variable resulted in a better model fit than when the actual level was used as a dependent variable. Just the opposite occurred for SFAS No. 36 interest rate reporting. The model fit for the equation with the actual level of SFAS No. 36 interest rate as the dependent variable was higher than the fit for the model with the change in interest rate.

6.2 Limitations

The limitations of this study extend to several areas. First, the model limited the activities of the hypothetical manager, restricting the manager's control over the bounds on contributions to only interest rate choice. There are actually several substitutes for the DOL interest rate choice as a control device to manipulate pension contributions. Studies that ignore such substitutes will have less explanatory power.

One substitute for this control variable is a selection (or change) of the actuarial cost method. Each actuarial cost method will produce a different cash flow schedule and, therefore, different bounds on contributions. As a result, the manager need not change DOL interest rate assumptions but can change actuarial cost methods. Other degrees of freedom of choice within a particular actuarial cost method would be (i) mortality and (ii) wage increase assumptions.

Besides simply controlling the funding bounds through either the DOL interest rate or the alternate choice variables just mentioned, there are direct substitutes for control of the funding bounds themselves. First, the company may directly apply for a temporary suspension of the minimum funding standard, obviating the need for any other strategies. Second, the company may terminate the plan in either an overfunded condition (and recover the excess assets) or an underfunded condition (and possibly escape further responsibility). Third, if the portfolio of pension plan assets does not already include the maximum amount allowed of the stock of the sponsor then the sponsor can "fund" by issuing common stock and no cash may change hands. Finally, the firm may spin off the segment of the company with the relevant pension plan and (for a price) terminate connections with the plan.

That substitutes exist for the DOL interest rate as a decision variable reduce the explanatory power of a model built on the DOL interest rate as the primary control variable. Consequently, the model suffers from a conceptual flaw in not recognizing the existence of substitutes for the DOL interest rate.

Also, even if managers do use the DOL interest rate primarily to control funding levels, this study may have incorrectly measured the DOL interest rate pertinent to the manager. First, in this study, all of the pension plans available for a year were included in the weighted average DOL interest rate for the firm in that year. As a possible result, the number of plans included in the weighting may have changed from year to year. In such a circumstance the plan missing for a particular year may have either been due to the use of one of the substitute strategies by management or the missing plan may have contributed to noise when the change in DOL interest rate was computed. A second difficulty in identifying the pertinent DOL interest rate occurs when the fiscal year of the plan is not identical with the fiscal year of the sponsor. In this study, each plan was identified as mostly influencing one year or the other. A reduction in noise may be possible by deleting such plans.

Certain measures of the independent variables are also subject to limitations. First, the measures of capital expansion did not attempt to discriminate between new expansion (the desired variable) and mere replacement of assets. Second, the pension ratio was subject to type I and type II errors (see Chapter Four). Third, the variable for the contemporary return on pension assets may not be the evidence relevant to the auditor. It may be that the auditor refers to the portfolio

composition of the pension assets rather than the raw return when the auditor constrains the choice of SFAS No. 36 interest rate. The return for a year should be related to the composition but is not identical with the composition.

6.3 Future Research

First, future research in a related vein should include an assessment of the conditions under which each of the choice variables listed in this chapter would be used. The substitutes for the DOL interest rate choice variable are likely to be imperfect substitutes. Hence, there should be marginal conditions under which each is the superior variable to manipulate to achieve the manager's goals. Future research could determine, both theoretically and empirically, the role each choice variable plays with respect to each other and with respect to the manager's goals.

Second, given a set of manager choice variables, the question also remains how different firm claimants value their claims. Equity claims should depend on managerial choice variables and certain studies have proceeded along these lines. For example, (see Chapter Two) interest rates have been included as determinants of equity value. However, in no case have such studies discriminated between DOL interest rates and SFAS No. 36 interest rates. Finer discrimination of the interest rate used as an independent variable represents one avenue of prospective research.

Another way of evaluating the determinants of equity value is to include more managerial choice variables as independent variables. All of the listed substitutes for the interest rate constitute candidates for inclusion. For example, given an equal level of pension ratio

between two firms, the equity should be valued at one level if all plans are funded in proportion to benefits and at a different level if (within a firm) some plans are in suspension of funding.

In conclusion, management choice of certain accounting variables is a part of the manager's overall consumption/production/investment plan. The current dissertation is part of a program seeking to determine (1) the causes of such managerial choices in the area of pension disclosure, (2) the effects of such managerial choices on other individuals, and finally (3) the relation of such managerial choices for pension disclosure on other accounting disclosures. It is hoped that this research will contribute to the resolution of such problems in the pension area.

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BIOGRAPHICAL SKETCH

Noel Addy was born in Biloxi, Mississippi, on January 4, 1951. Mr. Addy was raised in a variety of places, including Alaska, Texas, Virginia, and Arizona. In June, 1969, he graduated from Palo Verde High School in Tucson, Arizona.

Mr. Addy pursued his undergraduate studies at the University of Arizona while working at various part-time jobs. The Bachelor of Science in Business Administration with a major in accounting was awarded in December, 1974. A Master of Accounting was awarded in May, 1976 (also from the University of Arizona). In June, 1976, Mr. Addy began attending the University of Florida, where he studied for a Doctor of Philosophy degree with a major in accounting.

Mr. Addy married the former Shelley June Matthews on October 21, 1972, and currently has two sons, Noel III and Matthew David.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and qaulity, as a dissertation for the degree of Doctor Philosophy.

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